

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY—BULLETIN NO. 44.

D. E. SALMON, D. V. M., Chief of Bureau

INFECTIVENESS OF MILK OF COWS WHICH HAVE REACTED TO THE TUBERCULIN TEST.

BY

JOHN R. MOHLER, A. M., V. M. D.,

CHIEF OF PATHOLOGICAL DIVISION, BUREAU OF ANIMAL INDUSTRY.



WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1903.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., January 2, 1903.

SIR: I have the honor to transmit herewith a manuscript concerning the "Infectiveness of milk of cows which have reacted to the tuberculin test," by Dr. John R. Mohler, Chief of the Pathological Division of the Bureau. The work herein recorded deals with tuberculosis and the tuberculin test in a herd of cattle at St. Elizabeth Asylum, District of Columbia. I recommend that the manuscript be published as Bulletin No. 44 of this Bureau.

Respectfully,

D. E. SALMON, *Chief of Bureau.*

Hon. JAMES WILSON, *Secretary.*

CONTENTS.

	Page.
Preliminary notes	5
History and care of the herd	6
Stabling	7
Tuberculin test record of the St. Elizabeth herd, injected May 2, 1900	8
Result of first tuberculin test	9
Disinfection and isolation	13
Previous experiments with tuberculous milk	13
Present investigation	23
Technique of milk inoculations	23
Method of work	23
Condensed statistics relating to milk experiment	26
Suppression and eradication	82
Retest of twenty-six cows in dry barn	85
Summary of results of tuberculin tests	88
Conclusions	89
Acknowledgments	89
Bibliography	90



INFECTIVENESS OF MILK OF COWS WHICH HAVE REACTED TO THE TUBERCULIN TEST.

By JOHN R. MOHLER, A. M., V. M. D.,
Chief of Pathological Division, Bureau of Animal Industry.

PRELIMINARY NOTES.

During March and April of 1900 a highly fatal disease appeared among the cattle in the dairy herd belonging to the Government Asylum for the Insane at St. Elizabeth, D. C. Six or seven dry cows died in the course of a few days after exhibiting symptoms which pointed to the central nervous system as being the site of the principal disturbance. A number of other cows became similarly affected, and in the course of two weeks from the beginning of the outbreak eighteen animals had died, when the disease suddenly stopped.

None but dry cows became affected, and the fact that these animals had been kept in a small pasture some distance from the barns where a supposedly rabid dog had been seen among them five weeks before indicated that the disease might be rabies. The pronounced cerebral symptoms—that is, extreme irritability and nervousness, champing of the jaws, excessive frothing at the mouth, paralysis of the pharynx, and wild expression of the eyes—in connection with a noticeable alteration in the voice, and in two cases pronounced paralysis of the hind quarters, seemed to confirm the above diagnosis. Consequently a number of rabbits were inoculated intracerebrally with oblongata emulsion from four of the affected cows, and, with a single exception, all of these rabbits died with characteristic symptoms of paralytic rabies.

The postmortem examination of the eighteen cows in question revealed the fact that tuberculosis prevailed to a great extent in the herd, as at least twelve of the dead animals showed extensive tuberculous lesions. As a result of this it was considered desirable to have the entire herd examined for tuberculosis, and the Bureau of Animal Industry was requested to submit the cattle to the tuberculin test.

This investigation was referred to the Pathological Division of this Bureau, and arrangements were made without delay to carry it into effect. The following report deals with tuberculosis in this herd and not with rabies.

HISTORY AND CARE OF THE HERD.

Owing to the absence of any regularly kept herd book, no accurate knowledge could be obtained regarding the formation of the herd previous to 1865, when it consisted of 1 Jersey bull and 10 Jersey or Jersey grade cows. During that year 3 registered Jerseys—1 bull and 2 cows—were purchased in Pennsylvania, and the herd was gradually increased by raising the heifer calves until it numbered about 40 cows in 1875.

In 1878, 1 bull, 3 cows, and 6 heifers, all full-blood Ayrshires, were purchased from William Lindsay, of New Jersey, for the purpose of eliminating some of the Jersey blood, it being thought that the addition of this more vigorous stock would give better stamina to the herd. Such Jerseys as appeared weak and unthrifty were gradually weeded out and only apparently healthy Jersey cows were permitted to breed. The Ayrshire blood gradually replaced much of the Jersey strain until in 1885, by natural increase and by purchase of grade cows in Virginia and Maryland, the herd consisted of 100 milch cows, 50 heifers, and 3 bulls—2 Ayrshires and 1 Jersey. At this time it was considered one of the best-bred and best-producing herds in this section and was generally admired.

Early in 1888 the Jersey portion of the herd was increased by 7 full-blood cows purchased in Maryland.

On August 28, 1888, a further addition of the Ayrshire blood was made, as the original stock purchased in 1878 seemed to be decreasing and a new strain was thought desirable. Hence 1 bull and 7 cows, all full-blood Ayrshires, were purchased in Meadville, Pa., and from this nucleus originated the large number of Ayrshires which were in the herd in 1900, the Lindsay strain of Ayrshires having practically disappeared.

A departure from the Ayrshire-Jersey cross was made in March, 1890, when a Holstein-Friesian herd, consisting of 1 bull, "Shadeland Ruby's Duke," and 8 registered cows, were purchased.

This accession made quite an impression upon the herd, and during the next ten years the Jersey blood almost disappeared, until in 1900 the herd was nearly one half grade Holstein-Friesians, the other half Ayrshire and grades. On April 9, 1892, the late superintendent purchased 28 milch cows from a dairy farm at Whaylan, Mass.

When these cows arrived they were weak and unthrifty, and many of them were emaciated and had persistent coughs. The dairy attendants thought they had contracted the coughs en route, as they were on the cars for seven days, and during this period the weather was bleak. In the fall of 1892 four of these cows died, the history being that they coughed badly and gradually wasted away. Several of the

other cows of this purchase did not thrive, and it is the general supposition that tuberculosis was introduced with this stock.

Occasional deaths among the cattle occurred from the causes usually found on all large dairy farms, and Dr. Blackburn, pathologist of the hospital, has held postmortems on many of these carcasses, but no tuberculous lesions were observed until the outbreak of rabies in 1900.

STABLING.

Two large frame barns were used in which to stable the cattle; the smaller one, known as the dry barn, contained those that were advanced in pregnancy, while the larger one held the milking cows.

The lines of stalls in both stables were so arranged that the cattle faced each other, although in the large barn the distance between them was no less than 7 feet, and in the smaller barn, which contained but two rows of stalls, the runway separating them was over 15 feet wide. In the large barn were two double lines of stalls extending the length of the building. A passageway bisects these lines in such a manner as to make eight rows composed of sixteen cows each. A long continuous manger was in front of each row, from which the cows received their feed, and in winter their water also. The cattle were chained to posts running from floor to ceiling, but were not separated from each other in any way. They could eat each others' food, lick one another—in fact, were in intimate contact. It can readily be seen how a disease brought in by infected animals could be disseminated promiscuously to the adjoining cows of the same line through this system of stabling.

Owing to the absence of sufficient pasture in the vicinity, these animals were stable fed all the year. In the mild season the cows were allowed the freedom of an adjoining lot from 7 a. m. until 2 p. m., when they were stabled for the afternoon's milking, and remained in the barn until morning. During the winter season, if the weather permitted, they were turned out for exercise in the morning.

The feed consisted of the usual dairy ration, containing wheat bran, corn meal or rye middlings, and cut timothy hay, dampened before feeding. Sown forage corn was fed liberally to the cattle during the summer and corn fodder in the winter.

**TUBERCULIN-TEST RECORD OF THE ST. ELIZABETH HERD INJECTED
AT 10 P. M., MAY 2, 1900.**

Temperatures of the 12 cows slaughtered at Benning, D. C., June 15, 1900, before the milk experiment was made.

Number of cow.	Temperature taken.	6 a. m.	9 a. m.	12 m.	3 p. m.	6 p. m.	9 p. m.
No. 410.....	{ May 2	102.0	102.3	101.6	102.0	102.8	.....
	{ May 3	102.8	105.0	105.1	106.6	105.4	.....
No. 401.....	{ May 2	101.6	101.4	101.1	101.3	102.2	.....
	{ May 3	102.2	104.6	103.8	103.2	104.5	.....
No. 417.....	{ May 2	100.7	101.1	100.8	100.4	102.3	.....
	{ May 3	102.6	104.6	106.3	106.1	104.2	.....
No. 376.....	{ May 2	101.5	101.1	100.4	100.2	101.1	.....
	{ May 3	105.0	103.1	105.8	105.1	104.0	.....
No. 355.....	{ May 2	101.4	101.3	101.6	102.0	101.6	.....
	{ May 3	105.0	105.4	106.8	105.2	104.4	.....
No. 958.....	{ May 2	100.1	101.2	101.0	101.9	101.2	.....
	{ May 3	100.8	101.9	104.0	104.5	104.8	.....
No. 393.....	{ May 2	102.1	102.1	102.1	102.1	102.2	.....
	{ May 3	102.6	103.6	106.0	106.0	104.9	.....
No. 953.....	{ May 2	100.2	101.2	100.4	101.6	102.0	.....
	{ May 3	101.2	101.9	101.5	103.2	103.6	102.5
No. 356.....	{ May 2	101.4	102.2	101.8	102.0	102.0	.....
	{ May 3	107.8	104.5	106.3	104.8	104.2	.....
No. 383.....	{ May 2	105.8	106.4	106.0	106.6	106.4	.....
	{ May 3	(a)	(a)	(a)	(a)	(a)	(a)
No. 352.....	{ May 2	101.6	101.4	101.5	101.6	101.8	.....
	{ May 3	102.0	102.0	105.0	106.0	104.1	.....
No. 942.....	{ May 2	100.2	101.5	102.0	101.2	102.4	.....
	{ May 3	101.6	106.2	106.2	106.2	105.2	.....

a Not injected.

For postmortem notes on above cattle see page 11.

For the tuberculin records of the 56 cattle which were in the milk experiment, see pages 26 to 78, inclusive.

Record of the temperatures of the remaining cows in the first tuberculin test.

REACTING COWS.

Number of cow.	Temperature taken.	6 a. m.	9 a. m.	12 m.	3 p. m.	6 p. m.
No. 21.....	{ May 2	100.8	101.1	101.5	102.9	101.8
	{ May 3	104.4	104.0	105.8	105.1	105.3
No. 22.....	{ May 2	100.6	101.4	101.4	101.7	101.1
	{ May 3	101.4	102.8	103.6	105.6	104.3
No. 23.....	{ May 2	100.3	101.6	101.1	101.4	102.4
	{ May 3	102.0	103.0	104.9	105.0	105.3
No. 24.....	{ May 2	100.6	100.9	102.0	101.8	102.5
	{ May 3	101.9	101.0	104.6	104.4	103.3
No. 25.....	{ May 2	100.9	100.6	101.7	101.8	101.7
	{ May 3	102.8	104.1	105.0	105.2	104.0
No. 26.....	{ May 2	100.3	100.9	101.0	101.4	102.7
	{ May 3	105.3	107.4	106.2	105.9	105.6
No. 27.....	{ May 2	100.6	101.0	101.7	101.3	102.2
	{ May 3	104.5	106.5	105.9	105.0	104.3
No. 28.....	{ May 2	101.0	101.1	101.4	102.2	102.2
	{ May 3	103.8	104.0	106.6	104.0	103.0
No. 29.....	{ May 2	101.7	101.6	101.8	102.7	103.5
	{ May 3	106.4	104.4	106.6	105.7	103.6
No. 30.....	{ May 2	101.6	100.2	100.0	101.0	101.2
	{ May 3	106.7	104.2	103.2	104.0	102.4

On account of being dry these cows were not used in the investigation of the infectiousness of milk. Their numbers were given subsequent to the tuberculin test.

Record of the temperatures of the remaining cows in the first tuberculin test—Continued.

NONREACTING COWS.

Number of cow.	Temperature taken.	6 a. m.	9 a. m.	12 m.	3 p. m.	6 p. m.
No. 359.....	{ May 2 May 3	101.4 102.2	101.0 100.0	101.6 101.4	101.8 101.4	102.6 101.2
No. 360.....	{ May 2 May 3	101.1 101.3	101.2 100.6	102.0 101.2	102.0 101.2	102.2 101.3
No. 361.....	{ May 2 May 3	101.6 102.8	101.6 100.0	101.2 101.7	101.8 101.6	102.6 102.2
No. 362.....	{ May 2 May 3	101.8 102.2	101.8 100.6	102.0 101.2	102.2 101.3	103.0 101.4
No. 363.....	{ May 2 May 3	102.2 102.5	101.8 101.2	102.2 102.0	102.6 102.2	103.0 102.3
No. 364.....	{ May 2 May 3	101.2 101.8	101.2 100.4	102.4 102.2	102.0 101.6	102.3 101.3
No. 365.....	{ May 2 May 3	101.4 101.4	101.6 100.1	102.0 101.0	101.8 101.4	102.7 101.4
No. 366.....	{ May 2 May 3	101.5 101.7	101.2 100.3	102.0 101.2	101.6 101.2	103.2 103.0
No. 367.....	{ May 2 May 3	101.0 101.2	100.8 100.0	101.4 102.2	102.0 101.2	102.4 101.4
No. 368.....	{ May 2 May 3	100.8 102.3	101.0 100.2	102.2 101.2	102.0 101.8	102.0 101.4
No. 369.....	{ May 2 May 3	101.4 101.6	101.6 101.3	101.8 102.3	101.6 101.8	102.6 101.3
No. 370.....	{ May 2 May 3	101.8 103.0	101.6 100.0	102.0 101.0	102.4 102.8	103.4 102.3
No. 371.....	{ May 2 May 3	101.4 103.6	101.8 103.2	103.0 103.2	103.4 103.4	103.5 103.2
No. 373.....	{ May 2 May 3	101.3 101.6	100.4 100.2	100.4 101.6	100.4 103.0	101.0 102.4
No. 379.....	{ May 2 May 3	101.9 101.6	101.8 101.0	101.6 101.7	101.8 101.0	102.0 101.9
No. 380.....	{ May 2 May 3	102.0 102.6	101.6 101.2	101.8 102.6	101.6 102.6	101.8 102.6
No. 381.....	{ May 2 May 3	100.6 102.1	100.8 101.4	101.1 102.8	102.8 103.1	103.6 102.4
No. 384.....	{ May 2 May 3	101.5 102.0	100.6 101.8	101.0 102.0	101.1 101.9	100.8 101.4
No. 419.....	{ May 2 May 3	101.0 102.2	100.8 102.2	101.3 102.8	101.3 102.3	102.1 102.2
No. 421.....	{ May 2 May 3	102.0 (a)	104.9 (a)	102.9 (a)	104.0 (a)	103.6 (a)
No. 938.....	{ May 2 May 3	100.8 101.7	101.1 101.9	101.4 102.0	101.8 102.5	101.6 103.3
No. 940.....	{ May 2 May 3	100.6 100.8	100.8 101.6	101.2 102.7	101.7 103.0	101.1 102.2
No. 944.....	{ May 2 May 3	101.7 103.0	101.2 102.4	101.6 102.0	102.2 102.6	103.4 103.3
No. 954.....	{ May 2 May 3	101.3 101.7	101.2 101.3	101.2 102.0	101.2 101.9	102.2 103.0
No. 959.....	{ May 2 May 3	102.2 101.4	102.0 101.0	101.8 101.5	102.0 102.1	102.2 102.1
No. 960.....	{ May 2 May 3	101.7 101.8	102.2 102.4	102.0 103.2	101.8 103.0	102.4 103.0

(a) Not injected.

RESULT OF FIRST TUBERCULIN TEST.

On May 2 and 3, 1900, the herd, then consisting of 104 head, was tested with tuberculin. Only 2 cows, which showed excessive temperatures previous to the injection, were excluded from the test. One of these was nearing parturition, while the other was affected with

traumatic pericarditis caused by the penetration of a foreign body (piece of baling wire) from the reticulum through the diaphragm to the pericardium, and on account of this condition was one of the first 12 to be slaughtered without being tested. Of the remaining 102 head, 76 gave a decided reaction (see table, p. 8), while one cow, No. 953, showed a questionable rise, making the proportion of animals affected more than 74 per cent. Of the 25 animals which did not react, 13 had but recently been purchased from a farm in Virginia and had been kept in one line by themselves in a corner of the barn during the two weeks they had been in the asylum stables. They consequently served as an excellent check on the results of the tuberculin tests. If these 13 animals are excluded, it will be seen that more than 85 per cent of the old herd was tuberculous.

These results demonstrated beyond a doubt that radical measures must be taken at once in order to prevent the infection of the healthy animals, and especially to eliminate those which, on physical examination, were found to be affected with any of the forms of tuberculosis which are especially dangerous for the dissemination of the disease—that is, cavernous tuberculosis of the lungs, tuberculous ulcers of the intestines, tuberculous metritis, and tuberculosis of the udder.

In justification of the superintendent of the farm and barns it should be mentioned that the general appearance of the entire herd was not such as to lead a layman to suspect the extent to which the disease had spread among the animals. In fact, a physical examination of all the animals led to the selection of only 12 head for immediate destruction, and some of these were condemned principally on the testimony of the superintendent to the effect that they had recently begun to fall off to a marked degree or were of no further use to the dairy. A number of these animals were affected to such an extent that their continuation in the stable would mean a continued loss, since their yield of milk in no way corresponded to the cost of their keep, while, on the other hand, their presence in the stable would be a constant source of infection for the other animals. They were, therefore, taken to the public slaughterhouse at Benning, D. C., and destroyed on June 15, 1900. Ten of these animals had reacted to the tuberculin test; 1 (No. 383) was selected owing to the development of symptoms of traumatic pericarditis, while the twelfth cow (No. 953) was the one previously referred to that had shown the only suspicious rise of temperature not considered sufficiently definite to warrant her condemnation. By the test record (p. 8) it is seen that her highest temperature subsequent to the tuberculin injection was 103.6° , a rise of but 1.6° above normal. It was questionable whether this should be regarded as a reaction, and it was decided that the proper course would be to hold her for retest. However, owing to her general unthriftiness and the presence of chronic mastitis, which made the animal unfit for dairy purposes, she was destroyed at once.

A careful postmortem examination showed that the 10 reacting animals were affected with tuberculosis to a greater or less extent, while the cow giving the questionable rise of temperature showed only three encapsulated tuberculous centers, the size of hemp seeds, in one of the mesenteric glands. This gland was removed for the purpose of inoculating the tuberculous material into guinea pigs in order to test its virulence, but unfortunately it was mislaid in collecting the specimens to be brought to the laboratory. Of the 10 reacting cows 5 were found to be unfit for food, while the tuberculous alterations in the other 5 were confined to the lymph glands or else localized in such a way as to admit of complete excision and the passing of the carcasses for food. The cow which failed to give a precise reaction was also passed, while the twelfth cow (No. 383) was condemned owing to the presence of both tuberculosis and traumatic pericarditis.

A brief description and postmortem report of these cattle follow:

No. 410. Holstein raised on farm; 6 years old; delicate and unthrifty in appearance; glands apparently normal on examination; right lung slightly affected; bad cough; weight, 750 pounds.

Postmortem.—Miliary tubercles throughout both lungs, more numerous in caudal lobe of right lung. All mesenteric glands enlarged, some being as large as a hen's egg, and show various degrees of tuberculous degeneration. Fresh tubercles on peritoneal covering of liver.

Carcass condemned.

No. 401. Common stock; 7 years old; bought six months ago; in fair condition; becoming unthrifty; appetite poor; no milk; not wanted by farm superintendent; weight, 850 pounds.

Postmortem.—One small nodule the size of a pea in right ventral lobe of lung. Posterior mediastinal glands greatly affected and calcareous.

Carcass passed.

No. 417. Blue-spotted, common stock; 8 years old; bought three years ago; delicate; capricious appetite; thin condition; not wanted in herd; weight, 790 pounds.

Postmortem.—A few small encapsulated foci in both lungs. Both retropharyngeal glands the size of hens' eggs, and containing thick yellow pus. Right supramammary lymph gland greatly enlarged, but contains no tuberculous focus.

Carcass passed.

No. 376. Yellow, common stock; 7 years old; bought five years ago; in poor condition and becoming unthrifty; physical signs of tuberculosis present; sibilant râles; weight, 660 pounds.

Postmortem.—Extensive tuberculosis of both lungs. Bronchial and mediastinal glands all enlarged and completely degenerated. Both retropharyngeal glands the size of a hen's egg, containing pus. One mesenteric gland is swollen and contains a caseous tuberculous mass.

Carcass condemned.

No. 355. Grade Jersey; 14 years old; raised; losing flesh despite good appetite; left submaxillary gland enlarged; numerous râles distinctly heard in both lungs; weight, 660 pounds.

Postmortem.—Both lungs contain numerous nodules throughout the parenchyma, with two or three abscesses opening into bronchi. Extensive tubercular pericarditis and pearly disease of the pleura. Bronchial and mediastinal glands completely broken down. Left submaxillary gland and both retropharyngeal glands are enlarged and contents degenerated. Entire chain of mesenteric glands are extensively involved.

Carcass condemned.

No. 958. Jersey grade; 5 years old; bought two years ago; dry and not with calf; no use for dairy; weight, 775 pounds.

Postmortem.—Numerous small tuberculous foci in ventral and cephalic lobes of right lung. Mesenteric glands normal. Several abscesses in liver about 2 inches in diameter, but not of tuberculous nature.

Carcass passed.

No. 393. Grade Ayrshire; 9 years old; bought five years ago; in poor condition; physical symptoms apparent; weight, 950 pounds.

Postmortem.—The cephalic lobes of both lungs contain broken-down nodules and one large focus containing pus is seen in the right ventral lobe. Right bronchial gland normal in size, but presents a tubercular focus. Entire mesenteric chain affected; areas not very large, but numerous and calcareous. Supramammary gland as large as a duck's egg and watery, but did not show tubercle bacilli in cover-glass preparations.

Carcass condemned.

No. 953. Red grade; 7 years old; bought one year ago; chronic mastitis in one quarter of udder; poor feeder and in thin condition; not wanted by farm superintendent; weight, 675 pounds.

Postmortem.—Three small, well-defined foci the size of hempseeds in one of the mesenteric glands.

Carcass passed.

No. 356. Ayrshire grade; 10 years old; bought five years ago; very poor condition; shows typical signs of tuberculosis; weight, 725 pounds.

Postmortem.—Caseous tubercular area in posterior and lower portion of main lobe of right lung. Cephalic lobe consists almost entirely of a soft caseous mass. Left lung contains tuberculous nodules with calcareous centers in upper and posterior portion of main lobe. Both bronchial and anterior and posterior mediastinal glands contain cheesy masses and are three or four times their natural size. About twenty-five tuberculous foci scattered throughout the liver. Two nodules the size of peas in spleen. Udder is tuberculous, containing localized indurations with tubercles and ulcerations on the mucous membrane of the lacteal canals, especially in the left posterior quarter, but supramammary glands are apparently normal.

Carcass condemned.

No. 383. Holstein grade; in fair condition, but has developed characteristic symptoms of traumatic pericarditis. It was considered advisable to slaughter this animal at once, although she had not been subjected to the tuberculin test on account of pyrexia.

Postmortem.—Both lungs show caseous nodules scattered through the pyrenchyma. Bronchial and mediastinal glands greatly enlarged and degenerated. Submaxillary and retropharyngeal glands calcareous. A large fibrous tumor attaching the diaphragm to the reticulum and pericardium is seen embedding a piece of wire three inches in length. The tumor contains pus of a putrid odor.

Carcass condemned.

No. 352. Brown-and-white common stock; eight years old; not in milk; not pregnant; appetite capricious; no use to dairy; submaxillary glands about the size of walnuts; weight, 775 pounds.

Postmortem.—Submaxillary and retropharyngeal glands are all greatly enlarged and contain calcareous foci of tuberculosis. Liver shows three or four greenish abscesses about two inches in diameter, but not of a tuberculous nature.

Carcass passed.

No. 942. Red speckled, common stock; 7 years old; affected with chronic nymphomania; bought fresh three years ago, but has not been pregnant since; no further use to farm superintendent.

Postmortem.—One small well-defined tuberculous nodule in ventral lobe of left lung. Right and left bronchial lymph glands are as large as hens' eggs and have undergone caseous degeneration. Cephalic lymph glands normal.

Carcass passed.

DISINFECTION AND ISOLATION.

The general appearance of the herd, after the removal of the above-mentioned 12 individuals, a number of which showed more or less decided symptoms on physical examination, was quite satisfactory. It would, in fact, have been impossible to find any fault with the condition and appearance of the remaining cows. As before mentioned, there were two large well-ventilated stables 200 or 250 yards from each other, and it was, therefore, an easy matter to provide new quarters for the nonreacting animals. For this purpose the smaller barn was selected; and, in order to avoid a repetition of the extensive spread of the disease, great care was exercised in subjecting the premises to a thorough disinfection and renovation. The boards on the floors were scraped with hoes and were replaced where necessary; the floor, walls, ceiling, stalls, mangers, in fact, the entire stable, was cleaned first with hot water, then with a strong creolin solution. The woodwork was painted, and antiseptic whitewash applied to the brick and stone wall which formed one side of the stable. The old mangers were replaced by modern individual troughs, and the stanchions were constructed in such a manner as to make it impossible for the animals to get their heads together. When this work had been accomplished the 26 nonreacting cattle were stabled there, leaving 66 cows in the infected barn.

From this time the tubercular herd was kept strictly isolated from the healthy cattle and was supplied with separate attendants, dairy utensils, and such other details as were requisite for carrying out this purpose of segregation. The milk of the infected herd was submitted to the boiling temperature for 30 minutes before using, and every precaution was taken in the care of the animals to prevent their rapid decline.

PREVIOUS EXPERIMENTS WITH TUBERCULOUS MILK.

As the question of the infectiousness of milk from tubercular cows was then, as it is now, one of great importance, and as the opinions of the scientists who are recognized as authorities on such matters differ greatly regarding this subject, it was decided to take advantage of the opportunity which had presented itself and ascertain, so far as possible, to what extent the milk of the remaining tubercular, or reacting, cows contained tubercle bacilli. That milk coming from a tuberculous udder is capable of transmitting infection to experimental animals is conceded by all who have given the subject any consideration. It has been equally well established that in advanced generalized tubercu-

losis the udder may excrete tubercle bacilli without showing any indication of being affected. Careful experiments performed by trained and eminently responsible investigators have also demonstrated beyond reasonable doubt that the tubercle bacillus may at certain times enter the general circulation and be eliminated by the normal mammary gland of cows in which the disease is localized or in an incipient stage. Among the earliest investigations which proved positively that milk from tubercular cows contained an infectious principle were those of Gerlach (1869), who produced tuberculosis in calves, hogs, sheep, and rabbits by experiments in feeding, although clinical experience and observation of natural cases had previously led others to form the same opinion.

As early as 1850 the pathological anatomy of the tubercle occurring in the udders of tubercular cows was described by Gluge, and he also spoke of the probability of the milk from such udders transmitting the disease to calves.

Zurn (1872) obtained positive results by feeding swine with the milk of a cow affected with tuberculosis.

Klebs (1873) fed the milk of a tubercular cow to 5 guinea pigs, a dog, and a goat, with the result that 4 of the guinea pigs and both the dog and goat became tubercular. Three guinea pigs injected intra-abdominally with milk filtered through clay all died with lesions of tuberculosis. He concludes that the tuberculous virus is probably present in varying quantities in the milk of cows both greatly and slightly affected.

Semmer (1875-76) inoculated guinea pigs, sheep, and rabbits, some intravenously and others subcutaneously, with the milk of tuberculous cows and produced tuberculosis in 5 out of 11, or 45.4 per cent, of these animals.

Bollinger (1880) infected 1 out of 3 hogs which he fed on the milk of a tuberculous cow. The milk of another cow was fed to 5 hogs, with the result that they all died of tuberculosis. Neither of these cows showed tuberculosis of the udder. Another experiment, in which 6 pigs were used—2 fed cooked milk, 2 uncooked milk, and 2 control pigs—resulted in the death of the 2 animals fed on uncooked milk from a tuberculous cow, while the postmortem examination of the 2 checks and the 2 hogs fed cooked milk showed a normal condition, except an abscess in the liver of one of the last-mentioned hogs. This scientist was the first (1883) to positively establish the virulence of the secretions from a tuberculous udder. In 1883 May inoculated experimental animals with $1\frac{1}{2}$ to 10 c. c. of whole milk which he obtained from the udders of 6 tuberculous cows after they had been slaughtered. The milk from one udder, or 16.6 per cent, transmitted the disease, and in this case the mammary gland was found to be tuberculous.

Johne (1883) has compiled the results of previous feeding experi-

ments with milk of tubercular cows, and, after carefully eliminating questionable investigations, found that of 91 animals fed with this milk, 30.7 per cent became infected with tuberculosis.

Stein (1884) investigated the infectiousness of milk from 14 cows affected with generalized tuberculosis. Of this number 4, or 28.5 per cent, produced tuberculosis by intraabdominal inoculations of the milk into guinea pigs. The udders macroscopically appeared to be normal, but a microscopic examination of the tissues showed the presence of the tubercle bacillus in one of them.

Zschokke (1884) produced tuberculosis in 2 rabbits with the milk of a tubercular cow whose udder did not show any evidence of tuberculosis. His method of inoculation was a combination of the intraperitoneal injection and inhalation by spraying. Both rabbits having developed lesions of the abdominal cavity without any apparent pulmonary alteration proved the former method to be more efficient.

Imlach (1884) fed the milk of 3 tubercular cows to 3 calves, 4 pigs, 1 goat, 2 monkeys, and guinea pigs, with the result that only the monkeys developed experimental tuberculosis.

H. Martin (1884) made a study of the milk sold in Paris dairies. Of 13 samples examined 4 were without results; of the remaining 9, 3, or 33.33 per cent, were found to contain virulent tubercle bacilli by the inoculation of guinea pigs.

Wesener (1885) published the results of previous feeding experiments, 86 in number, conducted for the purpose of determining the infectivity of milk from tubercular cows. The milk was fed to 2 calves, both of which developed tuberculosis, while 75 per cent of the hogs and 50 per cent of the goats and sheep that were likewise fed also became tubercular; 40 per cent of the guinea pigs gave positive results, but rabbits gave very unsatisfactory, and the cats positively negative, results in these feeding experiments.

Bang (1885) in his experiments with milk from cows with tubercular udders produced the disease in 3 rabbits and 5 pigs by feeding. Four rabbits were inoculated with the skim milk from these cows and they all became infected. Microscopic examination of the sediment showed many tubercle bacilli, while a few were also observed in the milk and cream. Subsequently (1889) he tested the milk of 21 tuberculous cows with normal udders by inoculating 48 rabbits. Two, or 9.5 per cent, of these cows transmitted the disease. Later (1892) he injected 40 guinea pigs with milk from 28 cows affected with generalized tuberculosis and showed that virulent milk was being secreted by 4 of the animals, 3 of which were found to have lesions in the udder on postmortem examination. By intraabdominal inoculations of 28 guinea pigs with the milk of 14 tuberculous cows he found that 3 of the latter were excreting tubercle bacilli in the milk. The summary of these experiments shows that of 63 cows 9 gave virulent milk, and

of this number 3 had tuberculous udders, leaving 9.5 per cent of the cows with normal udders producing infectious milk. He concludes that in a majority of cases milk from tubercular cows with healthy udders is not necessarily dangerous, but should be regarded with suspicion.

Galtier (1889) failed to produce tuberculosis in 4 rabbits inoculated with milk from a tubercular cow with a normal udder. In a later experiment he obtained positive results from inoculating a rabbit with milk from an udder but slightly tuberculous. From this he claims that tuberculosis is found only when the udder is affected, but nevertheless believes that milk from all tubercular cows should be suspected.

Peuch (1889) injected 4 rabbits intraabdominally and fed 1 young pig with the milk of a cow having a tuberculous udder. All the rabbits developed generalized tuberculosis, but the pig resisted the exposure. In a previous experiment 2 pigs and 2 rabbits were fed the milk of a tubercular cow, and all became affected.

In the investigations of Hirschberger (1889) this author proved by intraabdominal inoculations of guinea pigs that the milk from 11 out of 20 cows, or 55 per cent, contained the tubercle bacillus. He placed his cows in three groups: the first were generalized cases, of which 80 per cent killed the guinea pigs with tuberculosis; the second were not so badly infected, but 66 per cent producing tuberculosis in the inoculated animals; while the third group contained cows that had lesions localized in the lungs, only 33 per cent of which group gave positive results. In a microscopic examination of the milk from the 11 cows that transmitted the disease, tubercle bacilli could be found in only one case.

Gebhardt (1890) has demonstrated the effect of dilution on the virulence of tuberculous milk. In the first series of experiments 5 guinea pigs were inoculated with milk from a tuberculous cow, as follows:

First with 2.5 c. c. undiluted.

Second with 2.5 c. c. of a dilution of..... 1 to 20

Third with 2.5 c. c. of a dilution of..... 1 to 40

Fourth with 2.5 c. c. of a dilution of..... 1 to 50

Fifth with 2.5 c. c. of a dilution of..... 1 to 100

The 2 guinea pigs receiving the undiluted and the 1-to-20 dilution of milk became tubercular. This experiment was twice repeated with practically the same results, from which fact he concludes that a certain degree of dilution (1 to 50) produces a marked diminution in the virulence of tuberculous milk. He also inoculated 10 guinea pigs intraabdominally, each receiving 2 c. c. of milk bought in Munich, with negative results.

J. McFadyean and Woodhead (1892) proved by the inoculation of milk from nontubercular udders, and of an emulsion prepared from the tissue of similar udders, that 2 cases (1 milk and 1 udder) out of 13 in all, or 13.3 per cent, contained the tubercle bacillus.

Fiorentini (1892) conducted 48 milk experiments by inoculating 76 guinea pigs and 4 rabbits. Of these 1 rabbit and 4 guinea pigs became tubercular. It was found on postmortem that 2 of the 17 cows producing the milk were affected with udder tuberculosis.

The previous experiments performed in this laboratory by Smith and Schroeder in 1893, and later by Schroeder (1894), also show the infectious nature of milk from tubercular cows. The first experiment resulted in producing tuberculosis in 41 per cent of the guinea pigs inoculated intraabdominally with the milk from 6 cows affected with generalized tuberculosis. The diseased guinea pigs were inoculated with the milk from 2 of the 6 cows; in other words, 33.33 per cent of the cows were secreting tuberculous milk. The later experiment by Schroeder was divided into three parts. The first, in which market milk from unknown cows was injected into guinea pigs, showed that 1 of 19 samples, or 5.2 per cent, produced tuberculosis in one of the experimental animals inoculated with it. The second was conducted with milk from 12 tubercular cows that had either given a reaction to tuberculin or evinced physical symptoms of the disease. By intraabdominal injections of the sediment of the milk into guinea pigs 1 cow, or 8.3 per cent, was found to be secreting tuberculous milk. The third series consisted in repeated injections intraabdominally of milk from 4 tubercular cows without obtaining any positive results.

In a bacteriological study of St. Petersburg milk, Sacharbekow (1893) inoculated 80 guinea pigs intraabdominally with 4 c. c. each. Four of the animals, or 5 per cent, died as a result of the tubercle bacilli in the milk.

Ernst (1890-1895), in conjunction with Peters, conducted an extensive experiment with the milk of 36 cows that apparently were without any affection of the udder. A microscopic examination of 121 slides made from the milk of these cattle showed 19 slides, or 15.7 per cent, to contain the tubercle bacillus. These 19 slides represented the milk from 12 of the cows, or 33.3 per cent, that were secreting tuberculous milk. Rabbits were injected subcutaneously with the milk and cream from 19 of these cows, 4 of which, or 21 per cent, transmitted the disease. The milk of 15 cows was subcutaneously inoculated into guinea pigs, with the result that 6 cows, or 40 per cent, were found to be excreting tubercle bacilli. By combining the entire number of cattle in this herd that was shown to possess tuberculous milk, it was demonstrated that at one time or another the milk of 50 per cent of the cows proved infectious. This author also fed 21 calves on the milk of 25 tubercular cows and produced tuberculosis in 8, or 38 per cent, of them. The same milk when furnished to 12 pigs caused tuberculosis in 5, or 41.6 per cent, of the animals. The feeding experiments with rabbits resulted in the death of 2 animals, or 4 per cent, from tuberculosis. Twenty-three of the cows whose milk was fed in

this investigation were slaughtered and all but 1 showed perfectly healthy udders on microscopic examination. In a subsequent experiment Ernst inoculated 25 rabbits with the market milk of Boston and 3, or 12 per cent, developed tuberculosis.

De Man (1893), in a series of experimental investigations for the purpose of demonstrating the influence of temperature on the tubercle bacillus, found that 8 guinea pigs inoculated with the emulsion of 4 tuberculous udders contracted tuberculosis.

In the suburbs of Copenhagen St. Friis (1893) obtained milk from 44 dairies each composed of 10 to 80 cows, and made 46 experiments with 84 rabbits and 4 guinea pigs. Of this number 37 rabbits and 4 guinea pigs died a few days after as a result of septic peritonitis, which left only 26 experiments to show final results. Four of these experiments killed 6 rabbits, and it was found later that the 2 dairies furnishing the samples of milk which caused the death of 2 of these rabbits had, respectively, 20 and 30 cows in the herds, 3 of which were affected with udder tuberculosis. The dairies supplying the milk that killed the other 4 rabbits were composed of cows with no apparent lesions of the udders. He also fed 2 rabbits for four months with dairy milk with negative results. The next year this author (1894) reports that of 33 samples of milk obtained from various dairies in Zealand none produced tuberculosis by inoculating laboratory animals.

Pearson (1893) produced tuberculosis in 2 pigs by feeding the milk of a cow which on postmortem showed pulmonary tuberculosis, but no udder lesion. Control pigs gave negative necropsies.

Law (1894) succeeded in infecting 3 calves from healthy parents with the milk of 3 cows affected with generalized tuberculosis but with apparently sound udders.

Hills and Rich (1894) found tuberculosis in a number of hogs that had been fed milk from a herd, 85.7 per cent of which were proved tubercular on postmortem examination, but without udder lesions.

Russell (1894) experimented with the milk of 7 tuberculous cows by inoculating rabbits. One cow, or 14.2 per cent, gave milk which killed both of the inoculated animals. The microscopic examination of the udder of this cow revealed the presence of the bacillus of tuberculosis.

Nocard (1896) obtained positive results in 3 out of 54 cases, or 5.5 per cent, by using milk from cows with advanced generalized tuberculosis. On further examination the udders of all 3 revealed tubercular lesions. He also claims (1884-1885) that the milk of tubercular cows will not transmit tuberculosis unless the udder is tuberculous. He examined the milk from a cow affected with advanced generalized tuberculosis, but found no tubercle bacilli present.

Obermüller (1897) injected small quantities of centrifugalized sediment of mixed milk into experiment animals and produced tuberculosis in 38 per cent of the animals. Later, 14 samples of butter made from the milk of these cows were injected into guinea pigs, resulting in the development of tuberculosis in every case.

The virulence of the market milk of Genoa, Italy, was studied by Massone (1897) by intraabdominal injection of guinea pigs, and it was found that the milk in 9 per cent of the samples contained virulent bacilli. The report of the medical officer of health of Liverpool to the Health Commission for 1897 records the examination, by the microscope and by inoculation experiments, of 158 samples of milk from different sources. Of 122 samples of city milk, 3, or 2.4 per cent, were found tuberculous. Of 24 specimens of country milk procured at the railway stations, 7, or 29.1 per cent, contained the bacillus of tuberculosis.

Delepine (1897) injected 36 samples of milk from Liverpool into guinea pigs, and found 1 sample, or 2.8 per cent, to contain the tubercle bacillus. In another series of experiments 2 out of 9 samples of milk from Liverpool were shown to be infectious to guinea pigs. This author also inoculated milk direct from the udders of 24 tuberculous cows, and found that 6, or 25 per cent, of the number produced tuberculosis in the guinea pigs. In a later article Delepine (1901) gives a table of the results obtained by inoculating guinea pigs with the milk of tubercular cows since 1896, and shows that 22.2 per cent of the cattle transmitted the disease.

Further evidence has been furnished by Ravenel (1897), who investigated the infectiousness of mixed milk from 5 tubercular cows with healthy udders by intraabdominal inoculation of guinea pigs. In 3 series of experiments, in which the milk was injected in its natural condition, 10 out of 66 guinea pigs, or 15.8 per cent, contracted tuberculosis as a result of the injection.

Petri (1898) injected 478 guinea pigs with 64 samples of the market milk of Berlin. In this investigation positive results were obtained in 9, or 14 per cent, of the cases, while 4, or 6.3 per cent, showed the acid-proof bacillus.

Beuge (1898) inoculated 18 guinea pigs intraabdominally with milk obtained in Halle. Eight of these animals died within a few days with septic peritonitis, while of the remaining 10 there were 3, or 30 per cent, that developed tuberculosis.

Ott (1898) proved that out of 43 samples of mixed milk 5, or 11.6 per cent, were infected. Ten guinea pigs each received intraabdominally 5 c. c. of mixed cream and sediment from the above 5 sources and 7 became tubercular. Of 30 guinea pigs inoculated with 5 c. c. of the whole milk 2 died of peritonitis, 4 died as a result of tuberculosis,

while the postmortem examination of 4 others that died of intercurrent diseases showed lesions which contained the tubercle bacillus, making 8 out of 28, or 28.5 per cent, tuberculous.

Kudinow (1898), in a study of the microorganisms present in the market milk of Dorpat, found by intraperitoneal inoculations of guinea pigs that 2.5 per cent of the samples contained the tubercle bacillus and concluded that the percentage was even greater, since many of the animals died as a result of other pathogenic bacteria in the milk before the tubercle bacillus had an opportunity to produce extensive lesions.

Kanthack and Sladen (1899) report that out of 16 dairies supplying 10 English colleges with milk 9, or 56.2 per cent, contained virulent tubercle bacilli. In this experiment 90 guinea pigs were used, 23, or 25.5 per cent, of which showed typical histological lesions. Thirteen of these were inoculated with cream, while 10 received injections of the centrifugalized sediment.

A. MacFayden (1899) examined 100 samples of the milk supply of Hackney district. Twenty-three of these samples caused peritonitis in the inoculated animals before tuberculous lesions could be established, while in the remaining 77 samples 17, or 22 per cent, produced tuberculosis.

Ostertag (1899) contends that the infection is to be considered only when the cow is sensibly affected, and in order to obtain evidence of the bacilli in milk of cows that do not show clinical symptoms, this investigation was undertaken. In the first experiment with the individual milk from 49 cows but 1 guinea pig died of tuberculosis, and this animal, the author claims, must have been infected before receiving the inoculation of milk. In another experiment with the mixed milk from this herd, 14 samples were used with the result that 1 of these samples, or 7.1 per cent, transmitted tuberculosis to 1 of 3 guinea pigs intraabdominally inoculated with the cream sediment. From this the author states: "The result of our second experiment plainly shows that in latent tuberculosis tubercle bacilli will occasionally find their way into the blood channels and from this source they may be carried through the milk into the outer world." At the same time he concludes that the milk of such cows offers no serious menace to the public health.

In direct opposition to this conclusion are those of Rabinowitsch and Kempner (1899), who succeeded in producing tuberculosis in guinea pigs with the milk of 10 out of 15 tuberculous cows, or 66.6 per cent. Two of these cows were later found to have tuberculous udders, 3 showed advanced generalized tuberculosis, while the remaining 5 animals were but slightly affected. The writers conclude that milk from cows with incipient tuberculosis, but without disease of the udder, may contain tubercle bacilli; also in latent forms of tuberculosis the milk may prove infectious, although the cow may not present any

clinical symptoms of tuberculosis, and therefore milk from all cows reacting to tuberculin should be considered as at least suspicious.

In 1897 Rabinowitsch showed by intraperitoneal injections of guinea pigs that 7, or 28 per cent, of the 25 samples of Berlin milk tested contained nocuous tubercle bacilli. This writer (1900) also studied the unsterilized milk of Berlin firms who sell their product at increased prices especially for the use of infants and invalids. Three of these dairies contained tuberculin-tested cows, while the remaining 5 were not subjected to such strict veterinary supervision. By intraperitoneal inoculation of guinea pigs it was observed that the milk of 3 of these 5 dairies possessed living virulent tubercle bacilli.

Adami (1899) believes that the cells of an actively secreting mammary gland of a cow can take up and discharge the tubercle bacillus without the animal showing any lesion of the lacteal tract. He and Martin examined the milk of 10 cows and when these were killed the udders were subjected to microscopic examination with negative results. In the milk of 6 (60 per cent) of these cows tubercle bacilli were observed by the aid of the microscope. The milk from the cow showing the greatest number of bacilli was inoculated into 2 guinea pigs and both died as a result of the infection. Twenty-nine guinea pigs and 26 rabbits were inoculated with varying quantities of milk and 1 calf was fed for five months, but only 2 guinea pigs died of tuberculosis.

Roger and Garnier (1899) injected the milk of a tubercular cow without udder lesions into the peritoneal cavity of 2 guinea pigs. They both contracted tuberculosis. The calf of this cow was allowed to suckle for only two days, but six weeks later it died with tuberculous lesions of the mesenteric lymph glands, the liver, spleen, and kidney.

In an article on tuberculosis, Annett (1900) publishes the results obtained by Boyce, who in 1898 examined 84 samples of Liverpool milk, of which 7, or 8.5 per cent, produced tuberculosis when inoculated into guinea pigs. In the study of 28 samples of country milk, 5, or 17.8 per cent, proved virulent to guinea pigs. In 1899, Boyce repeated these experiments, using 75 samples of town milk and 63 specimens of country milk, with the result that 6.6 per cent and 17.4 per cent, respectively, of these milks produced tuberculosis.

Marcone (1900) demonstrated the virulence of Naples milk by intraperitoneal inoculation of guinea pigs. Two series of experiments were conducted with the milk of 100 cows. In order to avoid a long series of experiments with each cow's milk separately, he collected the milk of several cows to form a single sample for study, so that the milk of the hundred cows was divided into 14 samples. In the first test of these samples 2 failed to give results, 6 gave positive, and 6 negative, or 50 per cent produced tuberculosis. In the second series of re-

searches the results were similar, since 7 gave positive and 7 negative findings.

Gehrman and Evans (1900) found tubercle bacilli in the milk of 15 out of 41 cows with sound udders, or 36.6 per cent. Guinea pigs inoculated with milk from 10 of these cows died of tuberculosis (24.3 per cent). As these results were not obtained from the same cows, the final showing is that 16 of the cows at one time or another gave milk containing tubercle bacilli, or 39.02 per cent. In 1895 Gehrman demonstrated by the microscopic examination of the milk of 38 cows with normal udders that 4, or 10.5 per cent, contained the tubercle bacillus. Subcutaneous inoculation of guinea pigs established the virulence of the tubercle bacillus in the secretions of 6, or 15.7 per cent, of the cows.

The most casual examination of the evidence deduced from these numerous experiments, performed by the leading investigators of many countries, shows clearly the danger to a susceptible subject of milk from a cow affected with tubercular mammitis or with advanced generalized tuberculosis which may be recognized by physical examination. The observations and deductions regarding this group of cases are practically uniform and the contradictory opinions appear to be relative to the possibility of a tuberculous cow with a healthy udder and without clinical appearances of the disease producing infectious milk. In the latter instance the evidence seems to be that the milk of such tubercular animals is capable of transmitting tuberculosis, the controversy relating more to the percentage of positive results obtained than to the diverse opinions of these investigators. While the tuberculin test can not be considered as an exclusive method for determining the infective property of milk, still the milk from cows which have given no other evidence of the presence of tuberculosis has, in a number of instances above related, produced the disease in susceptible animals. It has also been demonstrated and accepted by the majority of these writers that the infectivity of the milk of tuberculous cows increases with the stage and extent of the disease, as would be expected, but, on the other hand, the experiments of Gebhardt have shown that the danger of infection is diminished by mixing the milk of a number of cows together so that any infected sample becomes diluted.

In view of the evidence above submitted, it is apparent that the conclusion which maintains a sharp line of demarcation between the time immediately before the tubercle bacilli find lodgment on the susceptible mucous membrane of the lacteal tract and the period directly after such involvement occurs with the consequent pathological changes can not be considered as logical. Moreover, histological, bacteriological, and inoculation tests have disproved such reasoning and have fully demonstrated that the bacillus of tuberculosis may be eliminated by the blood through the mammary gland without this organ becoming affected. Despite these valuable contributions to our knowledge

of the infectiousness of milk from tuberculous cows, and although the study has been prosecuted for many years, there are many problems yet unsolved, and this most important subject still warrants additional experimentation and investigation to ascertain accurately and establish firmly the disputed points.

PRESENT INVESTIGATION.

For the reasons already mentioned and in consequence of the direct relation which tuberculous milk bears to human health, as well as to determine more definitely the relation which exists between the clinical aspect of the cows which have reacted to the tuberculin test, but which on physical examination are apparently healthy, and the infectivity of their milk, it was decided to ascertain, through feeding and inoculation experiments, whether the milk from the cows in question contained virulent tubercle bacilli, and, if so, to what extent. Samples of milk were therefore obtained in a sterile bottle from each cow once a day and carried immediately to this laboratory. Fifty-two of the 66 reacting cows were in milk, while the remaining 14 were dry, but subsequently 4 of these animals came in milk and were included in the experiment.

TECHNIQUE OF MILK INOCULATIONS.

METHOD OF WORK.

All milk used in these experiments was obtained about 2 o'clock daily, and consisted of the first portion of the milking, excluding the first few streams, which were always discarded in collecting the samples. Half-pint bottles were used in carrying the milk for the feeding experiments, and they were supplied with tight-fitting metallic covers. These bottles were always sterilized in the laboratory on the morning of the day on which they were to be used. The teats and udders were dampened with a 2 per cent solution of creolin, and, if possible, even more careful precautions were observed in securing the milk from the cows for intraabdominal inoculation. The milk for this purpose was collected in 1-liter serum bottles from but 2 cows a day. The bottles were then placed in the ice chest over night in order to allow the formation of cream. The following morning the cream was removed with a sterilized pipette, shaken up with twice its volume of sterilized water, and centrifugalized by electricity for 15 minutes at the rate of about 2,500 revolutions per minute. This apparatus was devised by replacing the hub and blades of an electric desk fan by the shoulder and arms of the medical hand centrifuge. This centrifugal machine was attached to the wall in an inverted position and encircled with a sheet of galvanized iron to prevent injury to the manipulator. With this electric apparatus work was made less laborious and also gave a more constant and uniform precipitation of the milk than could have been accomplished otherwise. The sediment

obtained was then injected into guinea pigs after the supernatant fluid had been drawn off with a sterile pipette.

After the cream had been removed from the original bottle for centrifugalizing, the milk was siphoned off to within 6 to 8 cm. of the bottom of the jar. This portion containing the sediment was drawn up with a sterile pipette and emptied into the tubes of the centrifugal machine. It was then subjected to the same treatment as the cream. In all cases from 4 to 6 cover-glass preparations were made from the centrifugalized sediment of both the milk and the cream, and examined microscopically after staining by Ziehl-Nielsen's method. All the injections were made into the peritoneal cavity of the guinea pigs after adhering to the usual aseptic precautions. The hair was clipped from a small area in the abdominal region, after which the skin was thoroughly carbolized, washed with alcohol, and rinsed with sterilized water.

The quantity injected varied somewhat, the first twelve receiving from 1 to 2 c. c., after which the amount was increased from 2 to 3 c. c., and still later as high as 5 c. c. was introduced into the abdomen. The milk was gathered by one of the laboratory assistants thoroughly acquainted with the precautions that should be observed in procuring it. As a rule, within one hour after it had been collected the milk would reach the laboratory and the contents of the small bottles fed at once to the guinea pigs, while the large bottles containing the milk for injection were kept on ice until the following morning. Three guinea pigs were assigned to each cow for the feeding experiments. In the inoculation tests 3 guinea pigs were usually injected in the first and 4 in the second series. The animals used in this investigation were in good condition and weighed from 11 to 19 ounces. They were obtained some from our own breeding pens and others from a well-known breeder with whose premises we are perfectly familiar. Spontaneous tuberculosis has not been known to occur in either place. Owing to an unfortunate circumstance it was possible to hold a post-mortem on 16 animals from the last-mentioned pens before the milk experiment had started, and this examination did not reveal any evidences of tuberculosis.^a All the animals in these experiments were placed in new cages and every known precaution was observed to prevent contamination from external sources. When deaths occurred the organs were carefully examined, cover-glass preparations made of the lesions, and the affected tissues preserved in Kaiserling's fluid. Owing to the more or less uncertain results obtained from making cultures, this procedure was dispensed with after a short trial, but in many cases the microscopic findings of the tubercle bacilli in sections

^a A number of guinea pigs had been placed in a box awaiting the arrival of some new cages, and inadvertently had been covered with other boxes, which, together with the extreme hot weather then present, caused 16 of them to be asphyxiated.

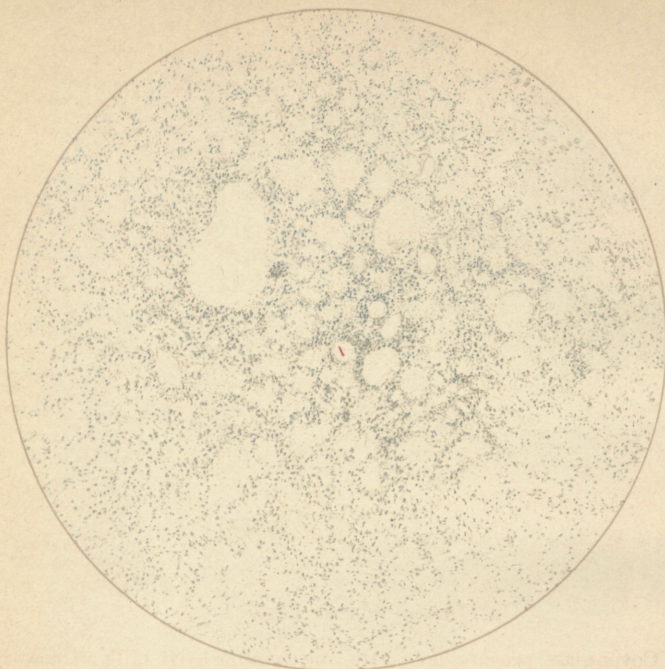


Fig. 1.

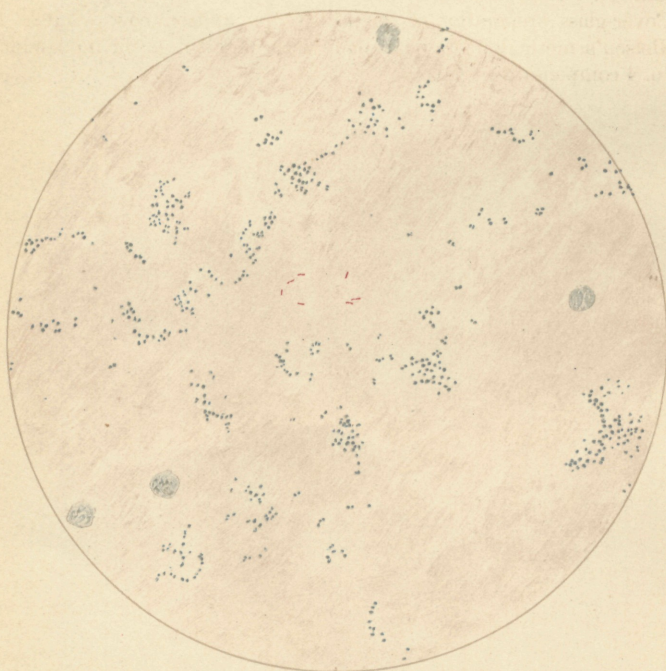


Fig. 2.

DESCRIPTION OF PLATE I.

Fig. 1. Cover-glass preparation of the uncentrifugalized milk of cow No. 102. Stained by Ziehl-Nielsen's method. Drawing made with Zeiss 2 mm. oil immersion objective and No. 4 compensating ocular.

Fig. 2. Cover-glass preparation of the milk sediment from cow No. 102. Stained by Ziehl-Nielsen's method. Drawing made with Zeiss 2 mm. oil immersion objective and No. 4 compensating ocular.

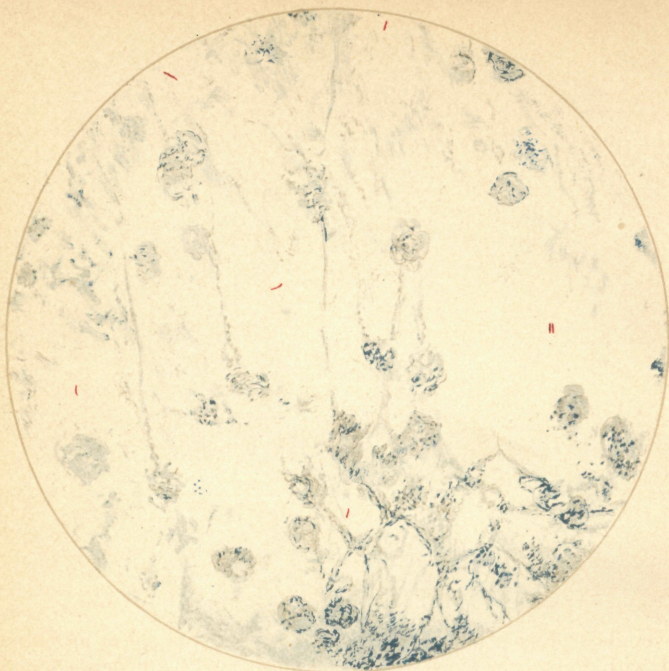


Fig. 1.

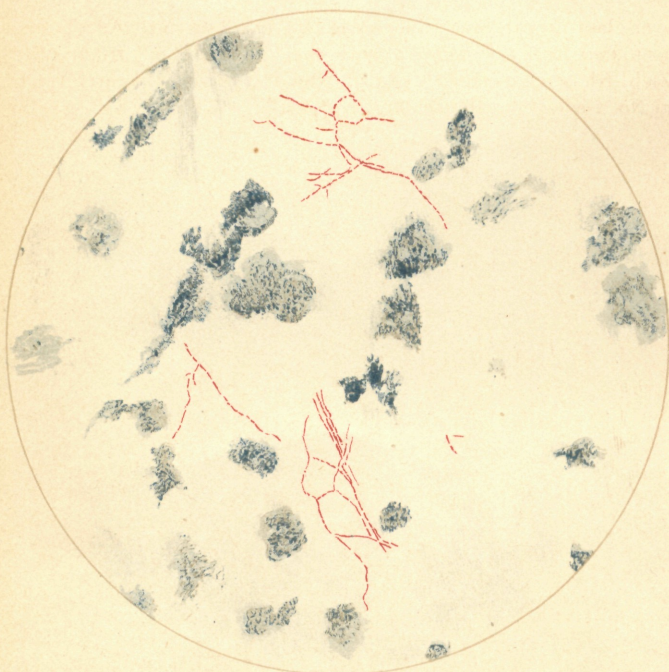


Fig. 2.

FIG. 1. TUBERCULOSIS BACILLI FROM SPLEEN OF GUINEA PIG, No. 28 A, COW No. 65.

FIG. 2. ACID-PROOF BACILLI FROM LIVER OF GUINEA PIG, No. 1563, COW No. 85.

DESCRIPTION OF PLATE II.

Fig. 1. Cover-glass preparation from a caseous focus in the spleen of guinea pig No. 28a, fed with milk from cow No. 65. Stained by Ziehl-Nielsen's method. Drawing made with Zeiss 2 mm. oil immersion objective and No. 4 compensating ocular.

Fig. 2. Cover-glass preparation from a caseous focus in the liver of guinea pig No. 1563, inoculated intra-abdominally with the milk sediment from cow No. 85. Stained by Ziehl-Nielsen's method. Drawing made with Zeiss 2 mm. oil immersion objective and No. 4 compensating ocular.

and cover-glass preparations were substantiated by a subseries of inoculations of an emulsion of the lesions into guinea pigs. (See table below.) This latter work was carried out for the purpose of establishing beyond peradventure that the lesions produced by the milk in these experiments were the result of the tubercle bacillus and not dependent upon the action of any of the "acid proof" bacteria. Only in the case of 3 guinea pigs inoculated with the milk of cow No. 85 (see p. 58) were the lesions caused by one of these microorganisms, Moeller's grass bacillus. (See Plate II, fig. 2.) This mycobacterium might be taken for the tubercle bacillus when the filaments become disrupted. It is also capable of producing lesions of a pseudotuberculosis in guinea pigs that would lead to confusion unless closely studied microscopically. In addition to this microorganism several others were isolated from the lesions resulting from these experiments, and in certain cases (cows Nos. 68, 79, and 105) they were directly responsible for the early fatalities noted. Among those most constantly present were staphylococci, streptococci, diplococci, sarcina, bacillus coli communis, bacillus mesentericus, pseudomonas pyocanea, bacillus subtilis, bacillus aromaticus, and several undetermined species.

Forty-three guinea pigs for use as checks in this investigation were placed in cages between the experimental animals and subjected to the same external influences as the latter. (See p. 26.) The results were entirely negative, but they support incidentally the positive evidence of the infectivity of the milk given below.

Positive results obtained by subinoculations of guinea pigs.

Guinea pig No.	Date of injection.	Source of material injected.	From cow No.	Date of death.	Postmortem diagnosis.
1075	Sept. 8	Guinea pig 12a.....	4	Oct. 19	Tuberculosis.
1125	Sept. 10	Guinea pig 10a.....	4	Sept. 23	Do.
1126	...do...	Guinea pig 19a.....	15	Oct. 2	Do.
141	Sept. 29	Guinea pig 31.....	64	Oct. 17	Do.
78	Aug. 22	Guinea pig 29a.....	65	Sept. 29	Do.
79	...do...	.....	65	Oct. 7	Do.
143	Sept. 30	Guinea pig 43a.....	71	Oct. 27	Do.
91	Sept. 16	Guinea pig 46a.....	73	Oct. 9	Do.
1782	Sept. 20	Guinea pig 50a.....	74	Nov. 8	Do.
1783	...do...	.....	74	Nov. 27	Do.
1079	Sept. 9	Guinea pig 58a.....	77	Sept. 30	Do.
1723	Nov. 25	Guinea pig 1682.....	98	Dec. 12	Do.
84	Aug. 31	Guinea pig 99a.....	102	Sept. 29	Do.
1944	Dec. 15	Guinea pig 1649.....	102	Jan. 14	Do.
1945	Dec. 18	Guinea pig 1650.....	102	Jan. 2	Do.
1355	Sept. 12	Guinea pig 103a.....	104	Oct. 11	Do.

Check guinea pigs.

Guinea pig No.	Location.	Date when killed or died.	Postmortem.
976	Adjoining cage 16 ^a	Oct. 23, 1900	No lesion.
993	Adjoining cage 16	Dec. 17, 1900	Do.
1022	do	do	Do.
1156	Adjoining cage 72	Dec. 10, 1900	Do.
1183	Adjoining cage 77	Dec. 30, 1900	Do.
1184	Adjoining cage 74	Nov. 7, 1900	Do.
1185	do	Oct. 31, 1900	Do.
1186	Adjoining cage 66	Dec. 17, 1900	Do.
1187	do	Sept. 12, 1900	Septic metritis.
1188	Adjoining cage 3	Jan. 22, 1901	No lesion.
1189	Adjoining cage 79	Dec. 10, 1900	Do.
1192	Adjoining cage 68	Sept. 17, 1900	Pneumonia.
1193	do	Jan. 8, 1901	No lesion.
1194	do	do	Do.
1200	Adjoining cage 19	Dec. 6, 1900	Do.
1201	do	Dec. 28, 1900	Do.
1202	do	do	Do.
1203	Kept in one large cage facing the experiment animals.	Dec. 10, 1900	Do.
1204		Nov. 2, 1900	Pneumonia.
1205		Dec. 30, 1900	No lesion.
1206		Dec. 16, 1900	Do.
1210		do	Do.
1211		do	Do.
1212		Aug. 2, 1900	Pneumonia.
1254	Adjoining cage 5	Nov. 9, 1900	No lesion.
1260	do	do	Do.
1275	Adjoining cage 86	Dec. 30, 1900	Do.
1276	do	do	Do.
1280	Adjoining cage 76	Oct. 31, 1900	Enteritis.
1281	do	Dec. 10, 1900	No lesion.
1305	Adjoining cage 106	Nov. 14, 1900	Do.
1309	do	do	Do.
1310	Adjoining cage 1	Nov. 12, 1900	Do.
1311	do	do	Do.
1312	Adjoining cage 95	Dec. 10, 1900	Do.
1313	Adjoining cage 78	Oct. 17, 1900	Do.
1314	do	do	Do.
1315	Adjoining cage 100	Jan. 22, 1901	Do.
1316	Adjoining cage 91	do	Do.
1317	do	Nov. 2, 1900	Do.
1318	Adjoining cage 108	Nov. 16, 1900	Do.
1319	do	do	Do.
1389	Adjoining cage 112	Jan. 22, 1901	Do.

^a Number of cage corresponds to the number of the cow.

CONDENSED STATISTICS RELATING TO THE MILK EXPERIMENT.

The following tables show, in a form convenient for comparison, the history, physical examination, tuberculin reaction, and postmortem examination, together with the results of the feeding and inoculation experiments, as well as the microscopic examination of the milk and cream of each individual cow in this test.

Cow No. 1. St. Elizabeth herd.

Age, 6 years; condition, fleshy; number of calves, 4; breed, grade Ayrshire; origin, raised.

Physical examination, September 26, 1900: Pulse, 38; respiration, 22; temperature, 101.4°. Superficial lymph glands, normal. Lungs: Percussion, normal; auscultation, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.8°	102.8°
9 a. m.	100.9	102.3
12 m.	101	104.3
3 p. m.	101	103.6
6 p. m.	101.8	103.2

Postmortem, Rosslyn, Va., December 17, 1900: Caudal node of posterior mediastinal lymph gland enlarged to size of a hen's egg, and contains caseous material. The other glands in this chain are slightly enlarged and contain a few necrotic centers from one-fourth to five-eighths of an inch in diameter. Eight or nine of the mesenteric lymph glands show a few tubercles from the size of a hemp seed to that of a pea.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
		c. c.				
1a	July 19 to Sept. 27 ..	80	Sept. 27	70	Not tuberculosis	
2a	July 19 to Oct. 9	80	Oct. 17	90	do.....	
3a	July 19 to Aug. 22 ..	80	Aug. 22	34	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
			c. c.				
1	July 26	Milk and cream	1.5	Oct. 31	97	No lesions	
2	do.....	do.....	1.5	Oct. 15	81	do.....	
3	do.....	do.....	1	Oct. 28	94	do.....	

SECOND SERIES.

Cow dry.

Cow No. 2. St. Elizabeth herd.

Age, 7 years; condition, good; number of calves, 4; breed, Holstein grade; origin, raised.

Physical examination October 18, 1900: Pulse, 42; respiration, 16; temperature, 100.6°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.9°	105.6°
9 a. m.	101.8	104.8
12 m.	101.6	105.6
3 p. m.	101.8	104.1
6 p. m.	102	102.8

Postmortem, Rosslyn, Va., December 11, 1900: One firm, caseous area about 2 inches in diameter in ventral lobe of right lung and surrounded by an inflammatory zone. Several encysted tuberculous foci in parenchyma of left caudal lobe about the size of a shellbark, which appear slightly calcareous on section.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
4a	July 9 to Oct. 9	c. c. 80	Nov. 23	137	No lesions	
5a	do	80	Oct. 10	93	Not tuberculosis	
6a	do	80	Nov. 5	119	No lesions	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
4	July 26	Milk and cream.	c. c. 2	Oct. 11	77	No lesions	
5	do	do	1.5	Nov. 13	110	do	
6	do	do	1	Sept. 11	47	Pneumonia	

SECOND SERIES.

1397	Oct. 11	Milk	3	Nov. 3	23	Not tuberculosis	
1398	do	do	5	Dec. 3	53	No lesions	
1399	do	Cream	3	Dec. 13	63	do	

Cow No. 3. St. Elizabeth herd.

Age, 6 years; condition, fair; number of calves, 4; breed, Ayrshire grade; origin, raised.

Physical examination, October 18, 1900: Pulse, 39; respiration, 21; temperature, 102.1°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.8°	102°
9 a. m.	101.6	102.5
12 m.	102	105.1
3 p. m.	102.6	105
6 p. m.	102.5	104.4

Postmortem, Fowlers, D. C., May 31, 1901: Two small, caseous nodules one-half inch in diameter, in cephalic lobe of right lung and three smaller areas in ventral lobe of left lung. In the large posterior mediastinal gland there is one tuberculous focus about one-half inch in diameter, completely calcified. One mesenteric gland is involved and contains a partly calcareous nodule three-eighths inch in diameter.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
7a	July 9 to Oct. 9	c. c. 80	Dec. 10	154	No lesions	
8a	do	80	Dec. 11	155	do	
9a	do	80	Dec. 30	174	do	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
7	July 27	Milk and cream.	c. c. 2	Nov. 6	102	No lesions	
8	...do...	...do.....	2	Oct. 22	87	...do.....	
9	...do...	...do.....	1	Oct. 15	80	...do.....	

SECOND SERIES.

1401	Oct. 12	Cream	3	Jan. 25	105	No lesions	Negative.
1402	...do...	...do.....	5	Jan. 29	109	...do.....	
1403	...do...	Milk	5	Dec. 20	69	Pneumonia.....	
1404	...do...	...do.....	3	Nov. 10	29	Not tuberculosis.....	

Cow No. 4. St. Elizabeth herd.

Age, 6 years; condition, fair; number of calves, 3; breed, Ayrshire grade; origin, raised.

Physical examination October 18, 1900: Pulse, 36; respiration, 19; temperature, 100.6°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 p. m.	101.8°	102.3°
9 p. m.	100.2	104.6
12 m.	100.8	106.2
3 p. m.	101.6	106.4
6 p. m.	101.4	104.6

Postmortem, March 26, 1901, at Fowlers, D. C.: Right posterior pharyngeal lymph gland contains several small tuberculous foci. Left posterior pharyngeal gland is completely degenerated, about the size of a pigeon's egg, and contains cheesy pus. The prepectoral glands are enlarged and show foci of tuberculosis. Left bronchial lymph gland is tuberculous and the posterior mediastinal glands contain five or six small caseous centers. The right principal lobe of lung contains five or six caseous areas varying in size from a pea to a hen's egg. One small focus in caudal lobe of left lung. The parietal pleura is covered with a tuberculous growth (pearl disease), forming adhesions with the right lung and extending over the thoracic surface of the diaphragm.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
		c. c.				
10a	July 9 to Sept. 10 ...	80	Sept. 10	63	Tuberculosis.....	Positive.
11a	July 9 to Sept. 26 ...	80	Sept. 26	79	...do.....	Do.
12a	July 9 to Sept. 8	80	Sept. 8	61	...do.....	Do.

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
10	July 27	Milk and cream.	c. c. 2	Sept. 8	43	Tuberculosis	Positive.
11	do.....	do.....	1.5	Nov. 6	102	No lesions	
12	do.....	do.....	1	Nov. 7	103	do.....	

SECOND SERIES.

1403	Oct. 11	Milk	5	Dec. 7	57	Not tuberculosis	
1404	do.....	do.....	3	Dec. 29	79	No lesions	
1405	do.....	Cream	5	Dec. 19	69	do.....	
1406	do.....	do.....	3	Nov. 1	20	Pneumonia	

Cow No. 5. St. Elizabeth herd.

Age, 7 years; condition, good; number of calves, 3 or 4; breed, Holstein; origin, raised.

Physical examination, October 18, 1900: Pulse, 47; respiration, 24; temperature, 101.1°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.4°	101.7°
9 a. m.	101.3	102.4
12 m.	101.4	106.5
3 p. m.	101.1	105.4
6 p. m.	102.1	106

Postmortem, Rosslyn, Va., February 1, 1901: Small calcareous focus the size of a hazelnut in ventral lobe of right lung. Anterior mediastinal gland contains three or four encapsulated foci one-third of an inch in diameter and of a gritty consistency.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.^a

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
13a	July 9 to July 15....	c. c. 80	Oct. 18	101	No lesions	.
14a	do.....	80	Oct. 4	87	do.....	
15a	do.....	80	Nov. 7	121	do.....	

^a This animal became dry shortly after feeding experiments began.

Cow No. 8. St. Elizabeth herd.

Age, 9 years; condition, good; number of calves, (?); breed, common; origin, bought three years ago.

Physical examination, September 19, 1900: Pulse, 50; respiration, 20; temperature, 101.6°. Glands: Submaxillary, normal; supramammary, normal; udder, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.6°	105°
9 a. m.	101.4	105
12 m.	101.2	106.2
3 p. m.	101.2	106.5
6 p. m.	102	103.8

Postmortem, Rosslyn, Va., December 17, 1900: Both retropharyngeal glands show several necrotic areas the size of hemp seeds. Left tonsil contains purulent nodule the size of an acorn. Few small necrotic foci in posterior mediastinal glands. One cluster the size of a hen's egg in anterior portion of principal lobe of right lung, which on section is partly calcareous. Similar lesion in apex of left lung.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
121a	July 9 to Sept. 23 ...	c. c. 80	Nov. 16	130	Normal	
122a	do	80	Dec. 29	173	do	
123a	do	80	Dec. 5	149	do	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
13	July 28	Milk and cream.	c. c. 3	Sept. 8	42	Not tuberculosis.....	
14	do	do	2	Oct. 6	70	Normal.....	
15	do	do	2	Oct. 15	79	do	

SECOND SERIES.

Cow dry.

Cow No. 10. St. Elizabeth herd.

Age, 6 years; condition, excellent; number of calves, 3; breed, grade Ayrshire; origin, raised.

Physical examination, October 10, 1900: Pulse, 38; respiration, 22; temperature, 101.7°. Lymph glands: Submaxillary, normal; supramammary, normal. Lungs: No record of examination.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	102°	102.4°
9 a. m.	101.5	102
12 m.	102.6	104.2
3 p. m.	102.6	105.8
6 p. m.	102.3	103.8

Postmortem, at experiment station, Bethesda, Md., November 13, 1901:^a Numerous foci of tuberculosis in the lymph glands at the base of the tongue. The glands are enlarged and the foci vary in size from one-eighth to 1 inch. The centers of some are softened, and a deposit of calcareous matter is present in the peripheral portions of the foci. The mediastinal glands are somewhat enlarged and contain tubercular foci in a partly broken-down condition. Scattered over the costal and pulmonary pleura are numerous tubercular excrescences which vary in size from a pea to confluent masses 4, 5, and 6 inches in diameter. Sprinkled throughout the lungs are groups of isolated and confluent tubercular nodules varying in size from one-eighth to 3 inches, some of which are in a broken-down condition and in direct communication with the bronchi. Scattered over the pericardium are tubercular growths similar to those on the pleura. On the surface of the liver, each adherent to it by means of a narrow band of tissue, are several tubercular tumors, from one-half to 2 inches in diameter. A few small tubercular foci are seen in the liver and portal glands. Surface of spleen and omentum are covered with tubercular excrescences.

Microscopic examination of centrifugal sediment of milk, positive; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
124a	July 9 to Aug. 21 ...	c. c. 80	Aug. 21	43	Pyemia	Negative. Do.
125a	July 9 to Oct. 9	80	Dec. 13	157	Pneumonia	
126a	do	80	Oct. 10	93	No lesions	
127a	do	80	Nov. 5	119	do	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
16	July 28	Milk and cream.	c. c. 3	Sept. 16	50	Not tuberculosis.....	
17	do....	do	2	Oct. 28	92	No lesions	
18	do....	do	2	Nov. 5	100	do	

SECOND SERIES.

1409	Oct. 11	Cream	5	Jan. 12	93	No lesions	
1410	do....	do	3	Dec. 17	67	do	
1411	do....	Milk	5	Dec. 30	80	do	
1412	do....	do	3	Nov. 27	47	Not tuberculosis.....	

Cow No. 12. St. Elizabeth herd.

Age, 8 years; condition, fair; number of calves, 4; breed, grade Holstein; origin, raised.

Physical examination, January 4, 1901: Pulse, 52; respiration, 24; temperature, 102.9°. Glands: Submaxillary, normal; supramammary, normal. Lungs: Percussion, apparently normal; auscultation, right lung, increased bronchial breathing; left lung, increased bronchial breathing.

^aFor the postmortem notes on cow No. 10 the writer is indebted to Dr. E. C. Schroeder, superintendent of experiment station, Bethesda, Md.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.9°	105.5°
9 a. m.	102.8	107.4
12 m.	102.6	104.9
3 p. m.	102.8	104.9
6 p. m.	102.8	103.7

Postmortem, Rosslyn, Va., February 5, 1901: Both lungs show miliary tuberculosis throughout the parenchyma of all the lobes. The parietal pleura on both sides contains numerous isolated and confluent grape-like masses (pearl disease). The bronchial and entire chain of mediastinal glands are enlarged and caseous. Five or six of the mesenteric glands enlarged, and contain cheesy deposits.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative

Feeding experiments

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
119a	July 9 to Oct. 9	c. c. 80	Nov. 28	142	No lesions.....	
120a	do	80	Nov. 11	125	do.....	
121a	do	80	Dec. 21	165	No evidence of tuberculosis.	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
22	July 30	Milk and cream.	c. c. 1.5	Oct. 24	86	Normal.....	
23	do	do	3	Oct. 15	77	do.....	
24	do	do	2	Oct. 7	69	do.....	

SECOND SERIES.

1420	Oct. 12	Cream	5	Dec. 26	75	No lesions	Positive.
1421	do	Milk	3	Dec. 6	55	Tuberculosis	
1422	do	do	5	Dec. 26	75	No lesions	

Cow No. 14. St. Elizabeth herd.

Age, 5 years; condition, good; number of calves, 2; breed, Ayrshire; origin, raised.

Physical examination, September 19, 1900: Pulse, 46; respiration, 17; temperature, 101°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	102°	103.1°
9 a. m.	100.4	103.8
12 m.	100.4	105.4
3 p. m.	101.6	105.2
6 p. m.	101.7	104.2

Postmortem, Rosslyn, Va., February 5, 1901: Caudal lobe of right lung contains a walnut-sized nodule, which appears calcareous on section. A few isolated excrescences are seen on the parietal pleura of each side. The entire posterior mediastinal chain of glands are enlarged, and the lymph structure is completely replaced by a calcareous deposit. Left bronchial gland is the size of a duck's egg and likewise calcified.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
		c. c.				
16a	July 9 to Oct. 9	80	Oct. 24	107	No lesions.....	
17a	July 9 to Sept. 9	80	Sept. 9	62	Not tuberculosis	
18a	July 9 to Oct. 9	80	Nov. 20	134	No lesions.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
			c. c.				
19	July 30	Milk and cream.	3	Nov. 3	96	No lesions	
20	...do...	...do	2	Nov. 12	105	...do	

SECOND SERIES.

Cow dry.

Cow No. 15. St. Elizabeth herd.

Age, 7 years; condition, fairly good; number of calves, 4; breed, grade Holstein; origin, raised.

Physical examination, October 10, 1900: Pulse, 42; respiration, 20; temperature, 101.2°. Glands: Submaxillary, normal; supramammary, normal; udder, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101°	106.9°
9 a. m.	101	105.2
12 m.	101.3	106.1
3 p. m.	101.5	106.9
6 p. m.	103	106

Postmortem, Rosslyn, Va., December 17, 1900: Caudal lobe of left lung has a number of caseous areas from the size of a pea to that of a walnut. Posterior mediastinal glands are enlarged and contain five centers of tuberculosis of a semicalcareous nature. The bronchial and prepectoral glands are slightly enlarged and contain small yellow tubercles that are undergoing cheesy necrosis. Two tuberculous ulcers, size of quarter and dime, at bifurcation of trachea. Six or seven of the mesenteric glands show a number of small caseous foci. Liver shows a caseous tuberculous focus size of a pea.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
19a	July 9 to Sept. 10....	c. c. 80	Sept. 10	63	Tuberculosis.....	Positive.
20a	July 9 to Sept. 11....	80	Sept. 11	64	do.....	Do.
21a	July 9 to Aug. 20....	80	Aug. 20	42	Enteritis.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
25	July 30	Milk and cream.	c. c. 2	Sept. 25	57	Tuberculosis.....	Positive.
26	do.....	do.....	2	Nov. 18	111	Normal.....	
27	do.....	do.....	2	Nov. 23	116	do.....	

SECOND SERIES.

1423	Oct. 13	Milk.....	5	Dec. 22	70	Not tuberculosis.....	
1424	do.....	do.....	3	Dec. 19	67	do.....	
1425	Oct. 15	Cream.....	5	Jan. 5	82	Normal.....	
1426	do.....	do.....	3	Jan. 15	92	do.....	

Cow No. 16. St. Elizabeth herd.

Age, 10 years; condition, unthrifty; number of calves, 6; breed, Holstein; origin, raised.

Physical examination, September 25, 1900: Pulse, 46; respiration, 18; temperature, 101.1°. Glands: Submaxillary, normal; supramammary, normal. Lungs: Percussion, normal; auscultation, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.....	101.1°	102.2°
9 a. m.....	101	102
12 m.....	100.8	103.5
3 p. m.....	101.2	105
6 p. m.....	102.1	103.5

Postmortem at experiment station, Bethesda, Md., November 23, 1901:^a The mediastinal glands, which are enlarged, contain a few very small tubercular foci. The posterior portion of the principal lobe of the left lung solidified for a distance of 5 inches from the tip forward. Similar mass, about 4 inches in diameter, in the dorsal portion of this lung. Sprinkled throughout the lungs generally are a few tubercular foci about 1 inch in diameter. The material in these lesions is undergoing softening, and two or three pockets, containing softened tubercular material, are in direct communication with the bronchial tubes.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

^a For the postmortem notes on cow No. 16 the writer is indebted to Dr. E. C. Schroeder, superintendent of experiment station, Bethesda, Md.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.*	Postmortem diagnosis.	Microscopic examination of lesions.
22a	July 9 to Aug. 14 ...	c. c. 80	Aug. 14	36	Not tubercular.....	
23a	July 9 to Sept. 25 ...	80	Nov. 15	129	do.....	
24a	July 9 to Aug. 31 ...	80	Aug. 31	53	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
29	July 30	Milk and cream.	c. c. 2	Sept. 8	40	Not tubercular	
30	do....	do.....	2	Nov. 5	98	No lesions apparent..	

SECOND SERIES.

Cow at the experiment station when the second test was made.

Cow No. 17. St. Elizabeth herd.

Age, 8 years; condition, good; number of calves, 3; breed, common; origin, bought 4 years ago.

Physical examination, October 25, 1900: Pulse, 36; respiration, 22; temperature, 100.6°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.1°	101.7°
9 a. m.	101.1	102.7
12 m.	100.8	105.3
3 p. m.	101	105.3
6 p. m.	102.5	105.2

Postmortem, Rosslyn, Va., February 1, 1901: Five tuberculous foci in posterior mediastinal glands from one-eighth to one-fourth inch in diameter and of a caseous nature. Several tubercular areas on dorsal border of caudal lobe of right lung size of a shellbark to a hen's egg. They have undergone caseous changes and show a tendency to coalesce. Liver contains a large abscess, not tubercular.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
161a	July 30 to Oct. 9	c. c. 80	Nov. 9	102	No lesions	
162a	do.....	80	Nov. 30	123	do.....	
163a	do.....	80	Nov. 14	107	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
192	Aug. 30	Milk.....	c. c. 3	Oct. 24	55	No lesions	
193	do....	do....	2	Nov. 27	89	do....	
194	do....	Cream.....	3	Nov. 22	84	do....	
195	do....	do....	2	Oct. 15	46	No apparent lesions..	

SECOND SERIES.

1472	Oct. 16	Cream	3	Jan. 5	81	No lesions	
1473	do....	Milk	4	Dec. 13	58	do....	
1474	do....	do....	2	Jan. 12	88	do....	

Cow No. 18. St. Elizabeth herd.

Age, 7 years; condition, good; number of calves, (?); breed, common; origin, bought 6 months before test.

Physical examination, October 25, 1900: Pulse, 44; respiration, 20; temperature, 101°; M. M., normal. Glands: Submaxillary, normal; supramammary, normal. Lungs: Percussion, right lung, clear, left lung, clear; auscultation, right lung, clear, left lung, clear.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.4°	102.4°
9 a. m.	100.9	102.3
12 m.	101	102.6
3 p. m.	101.4	105.3
6 p. m.	102	105.2

Postmortem, Rosslyn, Va., December 17, 1900: The posterior mediastinal glands are greatly enlarged and completely calcareous. The anterior mediastinal glands contain four necrotic foci from one-eighth to one-fourth inch in diameter. The bronchial glands are slightly increased in size and contain several caseous nodules from the size of a pea to a hazelnut.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
137a	July 31 to Oct. 9	c. c. 80	Nov. 12	104	Normal	
138a	do....	80	Nov. 26	118	do....	
139a	do....	80	Dec. 14	136	do....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
61	Aug. 4	Milk and cream.	c. c. 3	Aug. 7	3	Pyemia.....	
62	do.....	do.....	2	Oct. 3	60	Not tuberculosis.....	
63	do.....	do.....	2	Nov. 12	100	No lesions.....	

SECOND SERIES.

1427	Oct. 13	Milk.....	5	Dec. 22	70	Normal.....	
1428	do.....	do.....	3	Dec. 17	65	do.....	
1429	Oct. 15	Cream.....	5	Dec. 3	49	do.....	
1430	do.....	do.....	3	Dec. 15	61	Enteritis.....	

Cow No. 19. St. Elizabeth herd.

Age, 8 years; condition, good; number of calves, 4; breed, grade Ayrshire; origin, raised.

Physical examination, January 3, 1901: Pulse, 44; respiration, 20; temperature, 100.1°. Superficial lymph glands, normal. Lungs: Percussion apparently clear; auscultation, right lung, apparently normal; left lung, intermittent mucous râles.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	100.6°	104.5°
9 a. m.	101	106.5
12 m.	101.7	105.9
3 p. m.	101.3	105
6 p. m.	102.2	104.3

Postmortem, Rosslyn, Va., February 1, 1901: Posterior portion of left caudal lobe is entirely consolidated and broken down. The cephalic lobe of right lung is one mass of caseous tubercular material. Bronchial and both mediastinal glands enlarged and completely degenerated. Prepectoral gland contains three miliary indurated foci. Mesenteric glands show foci in five or six nodes. Omentum and peritoneum covered by grape-like clusters of tubercular neoplasms. Trachea contains fourteen small tuberculous ulcers with suppurating surfaces.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
170a	July 9 to Oct. 9.....	c. c. 80	Dec. 9	153	No lesions.....	
171a	do.....	80	Dec. 17	161	do.....	
172a	July 9 to Oct. 4.....	80	Oct. 4	87	Not tuberculosis.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
92	Aug. 14	Milk.....	c. c. 3	Oct. 22	69	No lesions.....	
93	do.....	do.....	2	Dec. 1	109	do.....	
94	do.....	Cream.....	3	do.....	109	do.....	
95	do.....	do.....	2	Sept. 8	25	Not tuberculosis.....	

SECOND SERIES.

1431	Oct. 13	Milk.....	3	Dec. 22	70	No lesions.....	
1432	do.....	do.....	5	do.....	70	do.....	
1433	do.....	Cream.....	5	Dec. 6	54	do.....	
1434	do.....	do.....	3	Dec. 17	65	do.....	

Cow No. 20. St. Elizabeth herd.

Age, 2½ years; condition, good; number of calves, 1; breed, Holstein; origin, raised. Physical examination, October 10, 1900: Pulse, 44; respiration, 21; temperature, 102°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101. 3°	103. 8°
9 a. m.	101. 4	105. 5
12 m.	101. 5	105. 7
3 p. m.	102. 2	105. 3
6 p. m.	102. 2	105. 1

Postmortem, Benning, D. C., March 9, 1901: The posterior mediastinal glands contain seven or eight encapsulated foci from one-fourth to five-eighths inch in diameter that show a calcareous infiltration. Left ventral lobe is transformed into a solid tuberculous mass and contains a semicalcareous material. Right lung contains a few small caseous nodules in caudal lobe. Pleural adhesions present on both sides, but no excrescences observed.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
131a	July 9 to Oct. 9	c. c. 80	Jan. 2	177	No lesions.....	
132a	do.....	80	Dec. 21	165	do.....	
133a	do.....	80	Nov. 12	126	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
88	Aug. 14	Milk.....	c. c.	Sept. 30	47	Not tuberculosis.....	
89	do....	do....	2	Sept. 25	42	do....	

SECOND SERIES.

1435	Oct. 13	Milk.....	5	Dec. 19	67	No lesions.....	
1436	do....	do....	3	Nov. 6	24	Not tuberculosis.....	
1437	do....	Cream.....	5	Dec. 20	68	No lesions.....	

Cow No. 64. St. Elizabeth herd.

Age, 5 years; condition, good; number of calves, 2; breed, Holstein; origin, bought 1½ years ago.

Physical examination, January 4, 1901: Pulse, 54; respiration, 20; temperature, 101.7°. Superficial lymph glands, normal. Lungs: Percussion, right lung, apparently normal; left lung, dullness along posterior superior border; auscultation, right lung, clear; left lung, mucous rales appearing intermittent.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.8°	105 °
9 a. m.	101	105.4
12 m.	101.4	106
3 p. m.	101	106.2
6 p. m.	101.1	105

Postmortem, at Fowlers, D. C., April 12, 1901: The principal lobe of left lung contains a cluster of tuberculous nodules covering an area 4 inches in diameter and leading into at least two bronchi. One small encysted focus in cephalic lobe of right lung. Posterior mediastinal glands contain several small tubercular foci from one-fourth to one-half inch in diameter and of a cheesy nature. Left pharyngeal gland is size of a hen's egg and on section shows a caseous change, with center calcareous. The mucous membrane of trachea presents 6 suppurating ulcers with irregular raised borders surrounded by a hyperemic zone. Liver contains several necrotic foci the size of a pea, of tuberculous nature.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
25a	July 9 to Oct. 9	c. c.	Nov. 9	123	No lesions.....	
26a	do....	80	Dec. 12	156	do....	
27a	do....	80	Oct. 10	93	Not tuberculosis.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
31	July 31	Milk and cream.	c. c. 3	Sept. 29	60	Tuberculosis	Positive.
32	do.....	do.....	2	Oct. 27	88	No lesions	
33	do.....	do.....	2	Nov. 17	109	do.....	

SECOND SERIES.

1476	Oct. 15	Milk.....	4	Dec. 18	64	No lesions	Positive.
1477	do.....	do.....	3	Nov. 15	31	Tuberculosis	
1478	do.....	Cream.....	3	Dec. 15	61	No lesions	
1479	do.....	do.....	5	Nov. 24	40	Tuberculosis	Do.

Cow No. 65. St. Elizabeth herd.

Age, 8 years; condition, unthrifty; number of calves, 3; breed, Holstein; origin, bought in Virginia one year ago.

Physical examination, September 11, 1900: Pulse, 57; respiration, 36; temperature, 102.9°. Glands: Right submaxillary, enlarged; supramammary, normal. Lungs: Percussion, right lung, dullness right posterior border; left lung, normal; auscultation right lung, mucous râles, with areas of silence; left lung, mucous râles.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.2°	102.2°
9 a. m.	101.9	103.6
12 m.	100.5	105.8
3 p. m.	102	104.3
6 p. m.	102.2	103.3

Postmortem, Rosslyn, Va., December 11, 1900: All the lobes of both lungs show advanced tuberculosis, several abscesses being in direct communication with the bronchi in the right caudal lobe. The bronchial glands are the size of a hen's egg and entirely caseated. The anterior and posterior mediastinal glands are greatly enlarged, the caudal node being the size of one's fist, the others in proportion, and all being calcareous on section. The right submaxillary, the prepectoral, the lumbar, the left deep inguinal, the portal, and almost the entire chain of mesenteric glands show more or less degenerated tuberculous foci. The pleura and peritoneum are covered with tubercular neoplasms (pearl disease), which are also found on the pericardium and on the serous covering of the bladder, liver, spleen, and stomach. The liver contains a semicalcareous area the size of a hen's egg. The left kidney shows three encysted tuberculous foci, one-third to three-fourths inch in diameter and of a caseous nature.

Microscopic examination of centrifugal sediment of milk, positive; of cream, positive.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
		c. c.				
28a	July 9 to Aug. 29 ...	80	Aug. 29	51	Tuberculosis	Positive.
29a	July 9 to Aug. 22	80	Aug. 22	44	do.....	Do.
30a	July 9 to Oct. 9	80	Oct. 30	113	do.....	Do.

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
			c. c.				
34	July 31	Milk and cream.	3	Aug. 12	12	Pneumonia.....	Negative.
35	do.....	do.....	2	Aug. 8	8	Subacute peritonitis..	

SECOND SERIES.

1480	Oct. 16	Cream	5	Dec. 23	68	No lesions	Positive. Do.
1481	do.....	do.....	3	Nov. 10	25	Tuberculosis	
1482	do.....	Milk	5	Nov. 28	43	do.....	
1483	do.....	do.....	3	Dec. 28	73	No lesions	

Cow No. 66. St. Elizabeth herd.

Age, 7 years; condition, poor; number of calves, 3; breed, Holstein; origin, raised. Physical examination, October 10, 1900: Pulse, 40; respiration, 20; temperature, 101.9° Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	102°	102.6°
9 a. m.	101.1	104.2
12 m.	100.1	106.5
3 p. m.	100.9	107.2
6 p. m.	101.2	106.6

Postmortem, Rosslyn, Va., December 11, 1900: Small tuberculus focus one-half inch in diameter in apex of cephalic lobe of right lung. Over the pleural surface of left lung are numerous isolated and confluent grape-like excrescences, while the parietal pleura shows a few scattered clusters. Both bronchial, anterior and posterior mediastinal, and the prepectoral glands all show miliary foci of tuberculosis.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
		c. c.				
31a	July 9 to Oct. 9	120	Nov. 8	122	No lesions.....	
32a	do.....	120	Nov. 17	131	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
37	July 31	Milk and cream	c. c. 3	Nov. 30	122	No lesions	
38	...do...	...do...	2	Nov. 26	118	...do...	
39	...do...	...do...	2	Oct. 4	65	...do...	

SECOND SERIES.

1470	Oct. 16	Cream	3	Jan. 4	80	No lesions	
1471	...do...	Milk	5	Nov. 19	34	Not tuberculosis	
1485	...do...	...do...	3	Jan. 25	101	No lesions	
1486	...do...	Cream	5	Jan. 12	88	...do	

Cow No. 67. St. Elizabeth herd.

Age, 4 years; condition, good; number of calves, 2; breed, Holstein; origin, raised. Physical examination, September 11, 1900: Pulse, 52; respiration, 26; temperature, 101.5°. Superficial lymph glands, normal. Lungs, apparently normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	100.4°	106.7°
9 a. m.	101.2	105.6
12 m.	101.2	106.2
3 p. m.	101.8	106.1
6 p. m.	102.2	105.1

Postmortem, Benning, D. C., March 8, 1901: In posterior portion of both principal lobes are several caseous nodules from one-half to 1½ inches in diameter. The ventral lobe of right lung contains four tuberculous areas that are partly broken down. Posterior mediastinal glands enlarged and contain six small calcareous foci varying in size from a hemp seed to that of a pea.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
33a	July 9 to Oct. 9	c. c. 80	Jan. 1	176	No lesions	
34a	...do	80	Nov. 24	138	...do	
35a	...do	80	Nov. 13	127	...do	

Inoculation experiments.

FIRST SERIES

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
40	July 31	Milk and cream.	c. c. 3	Oct. 5	66	No lesions	
41	do.....	do.....	2	Oct. 1	62	do.....	
42	do.....	do.....	2	Oct. 27	88	do.....	

SECOND SERIES.

1467	Oct. 15	Milk.....	3	Nov. 15	31	No evidence of tuberculosis.	
1468	do.....	Cream.....	3	Oct. 31	16	do.....	
1469	do.....	do.....	5	Nov. 20	36	do.....	

Cow No. 68. St. Elizabeth herd.

Age, 8 years; condition, good; number of calves, 3; breed, Jersey; origin, bought 4 years ago.

Physical examination, October 25, 1900: Pulse, 44; respiration, 22; temperature, 101.3°. Glands: Left submaxillary, the size of a walnut; supramammary, normal. Lungs: Percussion, normal; auscultation, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.....	101.4°	106.6°
9 a. m.....	100.9	104.1
12 m.....	101	104
3 p. m.....	101.2	102.4
6 p. m.....	102	102

Postmortem, Rosslyn, Va., December 11, 1900: Caudal lobe of left lung contains, on its dorsal border, one tubercle the size of a horse-chestnut. On section it is seen to have undergone caseous necrosis. The cephalic lobe of this lung has two pea-size nodules that are likewise cheesy in consistence. The right principal lobe shows two degenerated foci the size of chestnuts located near the apex and on section are found to be of a caseo-calcareous nature. Left submaxillary gland is slightly enlarged and on section shows 4 soft, yellowish tubercles. The caudal node of the posterior mediastinal glands is the size of a hen's egg and transformed into yellow cheesy detritus.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
36a	July 9 to Oct. 9	c. c. 80	Nov. 23	137	Not tuberculosis	
37a	do.....	80	Nov. 15	129	do.....	
38a	do.....	80	Nov. 18	132	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
43	Aug. 1	Milk and cream.	c. c.	Dec. 21	142	No lesions	
44	do	do	2	Sept. 28	58	Not tuberculosis	
45	do	do	2	Dec. 3	124	No lesions	

SECOND SERIES.

1461	Oct. 18	Milk	3	Nov. 5	18	Not tuberculosis	
1463	do	Cream	3	Dec. 13	56	No lesions	
1464	do	do	5	Nov. 17	30	Not tuberculosis	
1465	do	Milk	5	Nov. 2	15	Hepatic abscess	Negative.

Cow No. 70. St. Elizabeth herd.

Age, 6 years; condition, good; number of calves, 3; breed, Holstein; origin, raised.

Physical examination, September 11, 1900: Pulse, 44; respiration, 23; temperature, 103.1°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	102.4°	102.6°
9 a. m.	102	102
12 m.	102.1	102
3 p. m.	102.1	102.8
6 p. m.	101.9	104.3
9 p. m.		103.9

Postmortem, Fowlers, D. C., May 11, 1901: Ventral lobe of right lung shows three or four encapsuled tuberculous nodules from one-half to three-fourths inch in diameter. One small caseous focus in the caudal node of the posterior mediastinal gland. One mesenteric gland contains a necrotic focus of tuberculous origin one-eighth inch in diameter.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
39a	July 9 to Oct. 9	c. c.	Oct. 9	91	Not tuberculosis	
40a	do	80	Nov. 21	135	do	
41a	do	80	Nov. 12	126	do	

Inoculation experiments

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
			c. c.				
46	Aug. 1	Milk and cream	3	Nov. 25	116	No lesions	
47	do.....	do.....	2	Oct. 14	74	do.....	
48	do.....	do.....	3	Nov. 14	105	do.....	

SECOND SERIES.

1487	Oct. 18	Milk	5	Nov. 9	22	Not tuberculosis.....	
1488	do.....	do.....	3	Nov. 22	35	do.....	
1489	do.....	Cream	5	Jan. 10	84	No lesions	
1490	do.....	do.....	3	Jan. 13	87	do.....	

Cow No. 71. St. Elizabeth herd.

Age, 8 years; condition, fair; number of calves, 4; breed, grade Ayrshire; origin, raised.

Physical examination, November 27, 1900: Pulse, 45; respiration, 21; temperature, 102.1. Superficial lymph glands, normal. Lungs: Percussion, right lung, normal; left lung, posterior lobe gives a muffled sound; auscultation, right lung, apparently normal; left lung, mucous râles.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m	101.9°	102.4°
9 a. m	100.2	103.1
12 m	101.3	106.1
3 p. m	101.9	107.4
6 p. m	102.4	106.3

Postmortem, Rosslyn, Va., December 11, 1900: Right principal lobe contains many caseous foci that have not coalesced, varying in size from a pea to a shellbark. Left lung contains pus cavities in the center of principal lobe. Cephalic lobe has three caseo-calcareous areas the size of walnuts. Trachea contains five or six tuberculous ulcers on mucous membrane from three-eighths to three-fourths inch in diameter. Anterior mediastinal glands normal in size, but contain several small yellow caseous tubercles. Posterior mediastinal, left retropharyngeal, and one mesenteric gland are enlarged, and on section show cheesy degeneration.

Microscopical examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
		c. c.				
42a	July 9 to Aug. 12....	80	Aug. 12	34	Pneumonia	Negative.
43a	July 9 to Sept. 30 ...	80	Sept. 30	83	Tuberculosis	Positive.
44a	July 9 to Sept. 20 ...	80	Sept. 20	73	do.....	Do.

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
49	Aug. 2	Milk and cream.	c. c. 3	Aug. 5	3	Peritonitis.....	
50	do.....	do.....	3	Oct. 27	86	No lesions.....	
51	do.....	do.....	3	Nov. 5	95	do.....	

SECOND SERIES.

1491	Oct. 18	Milk.....	5	Dec. 22	65	No lesions.....	Positive.
1492	do.....	Cream.....	5	Nov. 23	36	Tuberculosis.....	
1493	do.....	Milk.....	3	Dec. 15	58	No lesions.....	Do.
1494	do.....	Cream.....	3	Dec. 14	57	Tuberculosis.....	

Cow No. 72. St. Elizabeth herd.

Age, 7 years; condition, good; number of calves, 3; breed, Holstein; origin, bought two years ago.

Physical examination, September 11, 1900: Pulse, 50; respiration, 20; temperature, 102.3°. Submaxillary glands, enlarged and indurated; supramammary glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.....	100.1°	103°
9 a. m.....	100.8	106.4
12 m.....	101	107
3 p. m.....	102	106
6 p. m.....	101.8	103.3

Postmortem: Animal died suddenly October 23, 1900, at the asylum, and was buried without a postmortem examination being made.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
113a	July 9 to Oct. 9.....	c. c. 80	Jan. 2	177	No lesions.....	
114a	do.....	80	Dec. 10	154	do.....	
115a	do.....	80	Aug. 15	37	Enteritis.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
52	Aug. 2	Milk and cream.	c. c. 3	Nov. 5	95	No lesions.....	
53	do.....	do.....	3	Nov. 2	92	do.....	

Inoculation experiments—Continued.

SECOND SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
1495	Oct. 18	Cream.....	c. c. 5	Dec. 17	60	No lesions.....	
1496	do.....	do.....	3	Nov. 13	26	Not tuberculosis.....	
1497	do.....	Milk.....	5	Dec. 21	64	No lesions.....	
1498	do.....	do.....	3	Dec. 19	62	do.....	

Cow No. 73. St. Elizabeth herd.

Age, 4 years; condition, good; number of calves, 2; breed, Holstein; origin, raised.

Physical examination, October 10, 1900: Pulse, 45; respiration, 23; temperature, 103.1°. Narrow chest. Submaxillary gland, enlarged; supramammary gland, normal. Lungs: Percussion, normal; auscultation, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.....	100.6°	102.2°
9 a. m.....	101.2	102
12 m.....	101.3	103.8
3 p. m.....	102.9	104.2
6 p. m.....	102.3	104.2

Postmortem, Rosslyn, Va., December 11, 1900: Right principal lobe of lung has area size of an egg containing caseous and semifluid material and a number of smaller foci with similar contents. Apex of left lung completely solidified with cheesy tuberculous mass. Anterior and posterior mediastinal, bronchial, right submaxillary, and right and left retro-pharyngeal glands all show small necrotic foci from one-fourth to three-fourths inch in diameter. Five mesenteric glands contain nodules of caseous material. Left kidney shows retention cysts.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
45a	July 9 to Oct. 7.....	c. c. 80	Oct. 7	90	Tuberculosis.....	Positive.
46a	July 9 to Sept. 15.....	80	Sept. 15	68	do.....	do
47a	July 9 to Oct. 9.....	80	Dec. 20	164	No lesions.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
54	Aug. 3	Milk and cream	c. c. 3	Nov. 20	109	No lesions.....	
55	do.....	do.....	3	Sept. 4	32	Not tubercular.....	
56	do.....	do.....	2	Sept. 11	39	do.....	
57	do.....	do.....	2	Sept. 25	53	do.....	

Inoculation experiments—Continued.

SECOND SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
1499	Oct. 18	Milk.....	c. c. 5	Nov. 19	32	Tuberculosis	Positive.
1500	do	Cream	5	Dec. 15	58	No lesions	
1501	do	Milk.....	3	Dec. 14	57	do	
1502	do	Cream	3	Nov. 15	28	Pneumonia.....	Negative.

Cow No. 74. St. Elizabeth herd.

Age, 4 years; condition, fairly good; number of calves, 1; breed, grade Holstein; origin, raised.

Physical examination, September 11, 1900: Pulse, 46; respiration, 22; temperature, 102.3°. Glands: Submaxillary, normal; supramammary, normal. Lungs: Percussion, normal; auscultation, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	103.2°	108°
9 a. m.	103.1	105
12 m.	103.1	106.2
3 p. m.	103	104.4
6 p. m.	102.6	105.1

Postmortem, experiment station, Bethesda, Md., November 23, 1901:^a Lungs: Posterior half of both principal lobes affected with tuberculosis. These lobes contain numerous cavities in communication with the bronchi. The right lobe contains one very large pocket, 4 by 6 inches in area. The cavities all contain more or less broken-down, pus-like, tubercular material. A similar but smaller cavity 1 inch in diameter in left cephalic lobe. Mediastinal glands enlarged and tubercular. Glands at base of tongue greatly enlarged and converted into tubercular material, which is very much softened. Liver: Sprinkled on surface and scattered through the parenchyma are tubercular nodules, varying in size from a pea to several inches in diameter. In some places the nodules have become confluent, forming tubercular masses 5 to 6 inches in diameter. Portal glands greatly enlarged, entirely tubercular and undergoing softening. The tubercular material in the liver varies from firm nodules to soft material which, on incision, flows like semifluid pus. Mesenteric glands show occasional tubercular lesions.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
		c. c.				
49a	July 9 to Aug 17....	80	Aug. 17	39	No apparent lesions.....	
50a	July 9 to Sept. 20....	80	Sept. 20	73	Tuberculosis.....	Positive.
51a	July 9 to Oct. 9....	80	Dec. 17	161	No lesions.....	

^aFor the postmortem notes on cow No. 74, the writer is indebted to Dr. E. C. Schroeder, superintendent of experiment station, Bethesda, Md.

Inoculation experiment.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
58	Aug. 3	Milk and cream.	c. c. 3	Nov. 19	108	No lesions	Negative.
59	do.....	do.....	2	do.....	108	do.....	
60	do.....	do.....	2	Sept. 6	34	Pneumonia.....	

SECOND SERIES.

Cow at the experiment station when the second test was made.

Cow No. 75. St. Elizabeth herd.

Age, 14 years; condition, rather poor; number of calves, 8; breed, grade Ayrshire; origin, raised.

Physical examination, October 18, 1900: Pulse, 32; respiration, 20; temperature, 101.6°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	102.6°	105°
9 a. m.	102.4	104.8
12 m.	102.9	105.2
3 p. m.	102.3	102.7
6 p. m.	102.4	102.4

Postmortem, Rosslyn, Va., February 5, 1901: Anterior mediastinal gland contains few tuberculous nodules. Right bronchial gland greatly enlarged, and on sectioning the contents are seen to be gritty. Posterior border of both caudal lobes of lungs contain several caseous foci size of beans. One caseous nodule in a mesenteric gland.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
51a	July 9 to Aug. 19....	c. c. 80	Aug. 19	41	Not tuberculosis	
52a	July 9 to Oct. 9	80	Dec. 2	146	No lesions	
53a	July 9 to Aug. 7	80	Aug. 7	29	Not tuberculosis	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
64	Aug. 6	Milk and cream.	c. c. 3	Sept. 3	28	Abscess at seat of inoculation.	Negative.
65	do.....	do.....	2	Oct. 12	67	No lesions	
66	do.....	do.....	2	Oct. 22	77	do.....	

Inoculation experiments—Continued.

SECOND SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
1503	Oct. 18	Cream	c. c. 3	Jan. 11	85	No lesions	
1504	do....	Milk	3	Dec. 11	54	do....	
1505	do....	Cream	5	Nov. 25	38	Pneumonia.....	

Cow No. 76. St. Elizabeth herd.

Age, 4 years; condition, good; number of calves, 1; breed, Holstein; origin, raised. Physical examination, October 18, 1900: Pulse, 32; respiration, 12; temperature, 101.5°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.2°	103.6°
9 a. m.	101.6	102.4
12 m.	101.6	104
3 p. m.	101.5	105.6
6 p. m.	102.4	103.6

Postmortem, Benning, D. C., March 8, 1901: Five small calcareous nodules in posterior mediastinal glands. Posterior pharyngeal glands are enlarged and show three or four calcareous foci in each, about one-fourth inch in diameter.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
54a	July 9 to Oct. 9	c. c. 80	Oct. 28	111	Not tuberculosis	
55a	do....	80	Oct. 18	101	do....	
56a	July 9 to Sept. 16 ...	80	Sept. 16	69	do....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
67	Aug. 7	Milk and cream.	c. c. 3	Sept. 12	36	Not tuberculosis.....	
68	do....	do....	2	Sept. 21	45	do....	
69	do....	do....	2	Aug. 23	16	do....	

SECOND SERIES.

1507	Oct. 18	Cream	5	Dec. 17	60	No lesions	
1508	do....	Milk	5	Nov. 8	21	Abscess at point of injection, with pyemia.	Negative.

Cow No. 77. St. Elizabeth herd.

Age, 7 years; condition, fair; number of calves, 4; breed, Jersey; origin, raised.

Physical examination, February 4, 1901: Pulse, 46; respiration, 22; temperature, 101.1°. Superficial lymph glands, normal. Lungs: Percussion, right lung, dullness; left lung, normal; auscultation, right lung, mucous râles; left lung, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	100.5°	102.4°
9 a. m.	101	105.3
12 m.	101	106
3 p. m.	100.8	106
6 p. m.	101.4	105.3

Postmortem, Fowlers, D. C., June 4, 1901: The posterior pharyngeal, the bronchial, and the anterior and posterior mediastinal glands are all enlarged and degenerated with caseous contents. The caudal and ventral lobes of left lung show five or six nodules from the size of a shellbark to a walnut that contain partly broken-down material. In the posterior portion of right caudal lobe several tubercular foci have coalesced, forming one large irregular tuberculous mass which appears to be separated from the normal lung tissue by a retaining band of fibrous tissue. The prepectoral glands are enlarged and edematous, but do not show any foci. The parietal pleura, the anterior surface of the diaphragm, portions of the peritoneum, and posterior surface of the liver are studded with numerous tubercles of varying size, forming the so-called "pearl disease." Five or six mesenteric glands show caseous nodules from one-sixteenth to one-fourth inch in diameter.

Microscopic examination of centrifugal sediment of milk, positive; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
57a	July 9 to Sept. 12....	c. c. 120	Sept. 12	65	Tuberculosis	Positive.
58a	July 9 to Sept. 8.....	120	Sept. 8	61	do	Do.

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
70	Aug. 8	Cream	c. c. 3	Aug. 12	4	Pneumonia.....	Positive.
71	do....	do.....	2	Nov. 16	100	No lesions	
72	do....	Milk.....	2	Oct. 3	56	Tuberculosis	

SECOND SERIES.

Cow dry.

Cow No. 78. St. Elizabeth herd.

Age, 9 years; condition, good; number of calves, 4 or 5; breed, common; origin, bought five years ago.

Physical examination, September 26, 1900: Pulse, 38; respiration, 18; temperature, 101.2°. Superficial lymph glands, normal. Lungs: Examination unsatisfactory, owing to nervous temperament of animal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.5°	102°
9 a. m.	101.6	101.3
12 m.	101.4	103.4
3 p. m.	101	104.3
6 p. m.	101.8	103.3

Postmortem, Rosslyn, Va., December 17, 1900: Generalized miliary tuberculosis invades all the lobes of the lungs. Prepectoral and suprasternal glands are slightly enlarged and contain caseous foci from one-eighth to three-eighths inch in diameter. Peritoneum and spleen covered with tubercular excrescences of a nature indicative of recent infection. Six or seven glands in mesenteric chain are affected, several showing calcareous deposits.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
		c. c.				
60a	July 9 to Sept. 12....	80	Sept. 12	65	Not tuberculosis	
61a	July 9 to Oct. 9.....	80	Nov. 25	139	No lesions.....	
62a	July 9 to Sept. 24....	80	Sept. 24	77	Not tuberculosis	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
			c. c.				
73	Aug. 9	Milk.....	3	Nov. 17	100	Normal.....	
75	do	do.....	2	Sept. 16	38	Not tuberculosis.....	
78	do	Cream.....	3	Sept. 7	29	Abscess at point of inoculation.	Negative.

SECOND SERIES.

Cow dry.

Cow No. 79. St. Elizabeth herd.

Age, 6 years; condition, poor; number of calves, (?); breed, Jersey; origin, bought three years ago.

Physical examination, October 18, 1900: Pulse, 42; respiration, 16; temperature, 102.4°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.6°	101.7°
9 a. m.	102.3	103
12 m.	101.4	105.3
3 p. m.	101.2	105.7
6 p. m.	101.2	102.9

Postmortem, Rosslyn, Va., February 5, 1901: Posterior mediastinal glands show two small foci of a semicalcareous nature. Lower border of ventral lobe of right lung contains a tuberculous area the size of a walnut. Left lung has a small tuberculous focus of putty-like consistency in ventral lobe size of a bean.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
		c. c.				
63a	July 9 to Aug. 29 ...	80	Aug. 29	51	Not tuberculosis	
64a	July 9 to Aug. 21 ...	80	Aug. 21	43	do.....	
65a	July 9 to Aug. 10 ...	80	Aug. 10	32	do.....	
66a	July 9 to Aug. 19 ...	80	Aug. 19	41	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
			c. c.				
76	Aug. 10	Milk and cream.	3	Sept. 14	35	Not tuberculosis.....	
77	do....	do.....	2	Sept. 21	42	do.....	

SECOND SERIES.

1519	Oct. 18	Cream	3	Nov. 16	29	Not tuberculosis.....	
1520	do....	Milk	3	Dec. 6	49	No lesions	
1521	do....	do.....	5	Dec. 19	62	do.....	
1522	do....	Cream	5	Oct. 31	18	Hepatic abscess	

Cow No. 80. St. Elizabeth herd.

Age, 9 years; condition, poor; number of calves, 4; breed, Holstein; origin, bought three years ago.

Physical examination, September 11, 1900: Pulse, 54; respiration, 18; temperature, 101.9°. Glands: Left submaxillary, enlarged; supramammary, normal. Tumor size of a goose egg on right flank above mammary gland. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.6°	102.2°
9 a. m.	101.4	101.3
12 m.	101.2	104.6
3 p. m.	102	105.7
6 p. m.	102.4	105

Postmortem, Rosslyn, Va., December 21, 1900: Two tuberculous nodules in apex of left lung size of shellbarks. The same number of slightly larger areas are present in the principal lobe of left lung. Left submaxillary, left bronchial and posterior mediastinal glands show miliary foci undergoing necrotic changes.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
		c. c.				
67a	July 9 to Oct. 9	80	Dec. 1	145	No lesions	
68a	do	80	Dec. 21	165	do	
69a	do	80	Oct. 10	93	Pneumonia	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
			c. c.				
80	Aug. 11	Cream	3	Sept. 7	27	Not tuberculosis	
81	do	do	2	Oct. 29	79	No lesions	
82	do	Milk	3	Sept. 3	23	Not tuberculosis	
83	do	do	2	Sept. 8	28	do	

SECOND SERIES.

1549	Oct. 18	Milk	5	Dec. 15	58	No lesions	
1550	do	Cream	5	Dec. 18	61	do	
1551	do	Milk	3	Dec. 15	58	do	
1552	do	Cream	3	Nov. 12	25	Not tuberculosis	

Cow No. 81. St. Elizabeth herd.

Age, 6 years; condition, good; number of calves, (?); breed, common; origin, bought 6 months before test.

Physical examination, September 10, 1900: Pulse, 38; respiration, 22; temperature, 101.8°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	102.9°	106.4°
9 a. m.	102.3	106
12 m.	102	105.8
3 p. m.	102.8	105.2
6 p. m.	103	104.5

Postmortem, Rosslyn, Va., February 5, 1901: Left posterior pharyngeal gland size of a hen's egg, and appears as a yellowish calcareous mass. Two hemp-seed foci in right bronchial gland. Caudal node of posterior mediastinal gland, small necrotic focus. One caseous nodule the size of a walnut in apex of right lung. Both lungs are adherent to the diaphragm by hypertrophied connective tissue.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
70a	July 9 to Oct. 9.....	c. c. 80	Dec. 13	157	Not tuberculosis.....	
71a	do.....	80	do.....	157	Normal.....	
72a	do.....	80	do.....	157	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
84	Aug. 12	Cream.....	c. c. 3	Nov. 20	100	Normal.....	
85	do.....	do.....	2	Oct. 27	76	do.....	
86	do.....	Milk.....	3	do.....	76	do.....	
87	do.....	do.....	3	Nov. 20	100	do.....	

SECOND SERIES.

1555	Oct. 20	Cream.....	5	Oct. 26	6	Peritonitis.....	
1556	do.....	do.....	3	Dec. 14	55	Normal.....	
1557	do.....	Milk.....	3	do.....	55	do.....	
1558	do.....	do.....	5	Dec. 31	72	do.....	

Cow No. 83. St. Elizabeth herd.

Age, 12 years; condition, good; number of calves, 8; breed, Ayrshire; origin, raised.

Physical examination, October 18, 1900: Pulse, 46; respiration, 18; temperature, 101.2°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.....	101.4°	103.6°
9 a. m.....	101.6	104.8
12 m.....	101.8	105.6
3 p. m.....	102.2	104
6 p. m.....	102.6	103.2

Postmortem, Benning, D. C., March 19, 1901: Caudal lobe of right lung shows three nodules the size of hazel nuts with caseous contents. In the cephalic lobe of left lung several tuberculous nodules have coalesced, and with the exception of the extreme apex this entire lobe is affected. Small calcified nodules size of hemp seed in one of the mesenteric glands.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
134a	July 9 to Oct. 9	c. c. 80	Dec. 13	157	No lesions.....	
135a	do	80	Dec. 27	171	do.....	
136a	do	80	Dec. 26	170	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
196	Aug. 30	Milk.....	c. c. 3	Sept. 22	23	Not tuberculosis.....	
197	do	do	2	Nov. 22	84	No lesions.....	
198	do	Cream.....	3	Nov. 19	81	do.....	
199	do	do	2	Sept. 11	12	Pneumonia.....	

SECOND SERIES.

1559	Oct. 19	Milk.....	5	Dec. 4	46	Not tuberculosis.....	
1560	do	do	3	Dec. 15	57	No lesions.....	
1561	do	Cream.....	5	Dec. 21	63	do.....	
1562	do	do	3	Dec. 17	59	do	

Cow No. 85. St. Elizabeth herd.

Age, 6 years; condition, good; number of calves, (?); breed, common; origin, bought six months before test.

Physical examination, October 18, 1900: Pulse, 30; respiration, 17; temperature, 101.5°. Superficial lymph glands, normal. Lungs: Percussion, normal; auscultation, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.....	101.8°	102.2°
9 a. m.....	102.1	102.3
12 m.....	101.3	104
3 p. m.....	101.6	103.4
6 p. m.....	101.7	104.3

Postmortem, at experiment station, November 13, 1901:^a Mediastinal glands greatly enlarged and filled with areas of broken-down tubercular material. Lungs: One small focus of tuberculosis in the middle of the right principal lobe, about one-fourth inch in diameter.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

^aFor the postmortem notes on cow No. 85 the writer is indebted to Dr. E. C. Schroeder, superintendent of experiment station, Bethesda, Md.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
140a	July 9 to Aug. 30.....	c. c. 80	Aug. 30	52	Hepatic abscess.....	Negative.
141a	July 9 to Oct. 9.....	80	Oct. 10	93	Not tubercular.....	
142a	do.....	80	Oct. 25	108	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
184	Aug. 29	Milk.....	c. c. 3	Sept. 3	5	Peritonitis.....	Negative. Do. Do.
185	do.....	do.....	2	Sept. 6	8	Pyemia.....	
186	do.....	Cream.....	3	do.....	8	do.....	
187	do.....	do.....	2	Sept. 1	3	Peritonitis.....	

SECOND SERIES.

1563	Oct. 19	Milk.....	5	Oct. 30	11	Pseudo-tuberculosis..	Acid proof bacillus. Do. Do.
1568	do.....	do.....	3	Nov. 6	18	do.....	
1565	Oct. 20	Cream.....	5	Dec. 22	63	No lesions.....	
1566	do.....	do.....	3	Nov. 16	27	Pseudo-tuberculosis..	Do.

Cow No. 86. St. Elizabeth herd.

Age, 7 years; condition, fairly good; number of calves, (?): Aborted 8-months' calf, June 3, 1900. Breed, common; origin, bought in Virginia six months before test.

Physical examination, October 18, 1900: Pulse, 38; respiration, 20; temperature, 101°. Superficial lymph glands, normal. Lungs: Percussion, normal; auscultation, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.....	101.5°	101.6°
9 a. m.....	101.2	101.2
12 m.....	101	103.8
3 p. m.....	101.2	104.3
6 p. m.....	101	103

Postmortem, Rosslyn, Va., February 8, 1901: Posterior mediastinal glands contain several small foci of caseous material the size of a pea. The bronchial glands are enlarged to the size of a hen's egg and contain a caseous mass, with slight tendency to calcification in the center.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
143a	July 9 to Oct. 9	c. c. 80	Nov. 2	116	No lesions	
144a	July 9 to Aug. 18 ...	80	Aug. 18	40	Not tubercular	
145a	July 9 to Sept. 14 ...	80	Sept. 14	67	do	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
188	Aug. 29	Milk	c. c. 3	Oct. 31	63	No lesions	
189	do	do	2	Aug. 31	2	Septicemia	
190	do	Cream	3	Nov. 20	83	No lesions	

SECOND SERIES.

1564	Oct. 19	Milk	3	Nov. 16	28	Not tubercular	
1567	do	do	5	Dec. 21	63	No lesions	
1568	do	Cream	3	Jan. 9	82	do	
1569	do	do	5	Jan. 11	84	do	

Cow No. 87. St. Elizabeth herd.

Age, 4 years; condition, fair; number of calves, 2; breed, grade Holstein; origin, raised.

Physical examination, October 25, 1900: Pulse, 38; respiration, 18; temperature, 100.6°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	100.1°	103.3°
9 a. m.	100.8	106.3
12 m.	101	106
3 p. m.	101	105.9
6 p. m.	101.7	104.9

Postmortem, Benning, D. C., March 19, 1901: The right posterior pharyngeal gland is of normal size, but contains three miliary foci with contents of a gritty nature. The posterior mediastinal glands show three or four foci one-third to one-half inch in diameter, firmly encapsulated and completely calcified.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
146a	July 9 to Oct. 9	c. c. 80	Jan. 3	178	Normal	
147a	do	80	Dec. 11	155	do	
148a	do	80	do	155	do	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
176	Aug. 28	Milk.....	c. c. 3	Oct. 31	64	Normal.....	
177	...do...	...do.....	2	Nov. 3	68	...do.....	
178	...do...	Cream.....	3	Nov. 4	69	...do.....	
179	...do...	...do.....	2	...do...	69	...do.....	

SECOND SERIES.

1571	Oct. 19	Milk.....	3	Dec. 21	63	Normal.....	
1572	...do...	...do.....	5	Dec. 17	59	...do.....	
1573	Oct. 20	Cream.....	5	...do...	58	...do.....	
1574	...do...	...do.....	3	Jan. 14	86	...do.....	

Cow No. 88. St. Elizabeth herd.

Age, 5 years; condition, fair; number of calves, 2; breed, Jersey grade; origin, bought six months before test in Virginia.

Physical examination, October 25, 1900: Pulse, 50; respiration, 24; temperature, 101.7°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.....	101.2°	102.2°
9 a. m.....	101.8	105.9
12 m.....	100.8	106.2
3 p. m.....	101	106.3
6 p. m.....	101.8	105.8

Postmortem, Asylum, November 25, 1900: Aborted November 23; death due to puerperal septicemia. Caseous focus size of an acorn in ventral lobe of right lung. The same lobe of left lung shows several foci of a caseo-calcareous consistency. Anterior and posterior mediastinal glands show recent infection of miliary tuberculosis. Posterior pharyngeal glands similarly affected. Liver shows many angiomata. Uterus contains decomposed placenta and muco-sanguinolent fluid. Spleen pulp soft and tarry.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
149a	July 9 to Oct. 9.....	c. c. 120	Dec. 1	145	No lesions.....	
151a	...do.....	120	Dec. 24	168	...do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
180	Aug. 28	Milk.....	c. c.	3	Oct. 31	65	No lesions.....
181	...do...	...do.....		2	Nov. 5	70	...do.....
182	...do...	Cream.....		3	Nov. 4	69	...do.....
183	...do...	...do.....		2	Nov. 5	70	...do.....

SECOND SERIES.

Cow dry.

Cow No. 89. St. Elizabeth herd.

Age, 5 years; condition, good; number of calves, 2; breed, grade Holstein; origin, raised.

Physical examination, October 18, 1900: Pulse, 44; respiration, 22; temperature, 101.9°. Glands: Submaxillaries, large as walnuts and indurated; supramammary, normal. Lungs: Percussion, apparently normal; auscultation, apparently normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.....	101.7°	103.2°
9 a. m.....	101.2	105
12 m.....	100.2	105.8
3 p. m.....	101.4	105.8
6 p. m.....	102.1	105.7

Postmortem, Rosslyn, Va., February 5, 1901: The caudal lobe of left lung contains a large irregular mass of tuberculous material 4 by 6 inches which is completely broken down. Both submaxillary glands and the bronchial glands are greatly enlarged and filled with caseous material. The posterior mediastinal glands are enlarged, the caudal node being the size of an apple, and the entire chain is caseous.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
152a	July 9 to Oct. 9.....	c. c. 80	Dec. 14	158	No lesions.....	
153a	...do.....	80	Dec. 18	162	...do.....	
154a	...do.....	80	Dec. 21	165	...do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
124	Aug. 19	Milk.....	c. c.	3	Nov. 16	89	No lesions.....
125	...do...	...do.....		2	...do...	89	...do.....
126	...do...	Cream.....		3	Nov. 9	82	...do.....
127	...do...	...do.....		2	...do...	82	...do.....

Inoculation experiments—Continued.

SECOND SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
1577	Oct. 23	Cream.....	c. c. 5	Nov. 16	25	Not tuberculosis.....	
1578	do.....	do.....	3	Nov. 7	16	do.....	
1598	do.....	Milk.....	5	Dec. 3	42	No lesions.....	
1599	do.....	do.....	3	Dec. 5	44	do.....	

Cow No. 91. St. Elizabeth herd.

Age, 5 years; condition, fair; number of calves, 2; breed, grade Holstein; origin, raised.

Physical examination, September 25, 1900: Pulse, 46; respiration, 19; temperature, 100.7°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.....	101.4°	105.3°
9 a. m.....	101.2	106.4
12 m.....	100.8	105.8
3 p. m.....	101.2	106.1
6 p. m.....	102.4	105.4

Postmortem, Benning, D. C., March 8, 1901: Several calcareous areas from one-half to 1 inch in diameter are seen in principal lobes of both lungs. Posterior mediastinal glands are all enlarged, especially the caudal node, and contain calcareous foci varying from the size of a pea to a shellbark. Liver contains two nodules the size of a walnut filled with caseous tubercular material slightly calcareous in the center.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
155a	July 9 to Sept. 4.....	c. c. 80	Sept. 4	57	Not tuberculosis.....	
156a	do.....	80	do.....	57	do.....	
157a	July 9 to Sept. 24.....	80	Sept. 24	77	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
172	Aug. 27	Milk.....	c. c. 3	Dec. 11	106	No lesions.....	
173	do.....	do.....	2	Sept. 25	29	Not tuberculosis.....	
174	do.....	Cream.....	3	Sept. 24	28	do.....	
175	do.....	do.....	2	Oct. 4	39	do.....	

SECOND SERIES.

• 1575	Oct. 20	Milk.....	5	Dec. 20	61	No lesions.....	
1576	do.....	do.....	3	Dec. 22	63	do.....	
1581	Oct. 22	Cream.....	5	Dec. 5	46	Not tuberculosis.....	
1582	do.....	do.....	3	Dec. 15	56	do.....	

Cow No. 92. St. Elizabeth herd.

Age, 8 years; condition, thin, poor feeder; number of calves, 4; breed, graae; origin, bought in Virginia six months before test.

Physical examination: Pulse, 66, and weak; respiration, 27; temperature, 103.1°. Superficial lymph glands, normal. Edema of the dewlap. Diagnosis: Traumatic pericarditis on November 22, 1900.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	102°	102°
9 a. m.	101.1	104.2
12 m.	100.1	105.3
3 p. m.	100.8	105.4
6 p. m.	101.9	104.6

Postmortem, Rosslyn, Va., December 11, 1900: Small calcareous nodule one-half inch in diameter in principal lobe of right lung; small caseous foci in cephalic lobe. Left lung shows a tuberculous mass, with completely degenerated contents, along entire posterior border of caudal lobe. The bronchial glands contain several necrotic foci. Anterior and posterior mediastinal glands affected with old tubercular deposits that appear gritty on section. Pericarditis with fibrous mass connecting reticulum to the diaphragm resulting from a foreign body, which was found.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
73a	July 9 to Oct. 9	c. c. 80	Dec. 15	159	Normal	
74a	do	80	Dec. 4	148	do	
75a	do	80	Oct. 15	98	No marked lesions.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
160	Aug. 25	Milk.....	c. c. 3	Dec. 15	112	No lesions	
161	do	do	2	Nov. 5	72	do	
162	do	Cream	3	Dec. 4	101	do	
163	do	do	2	Sept. 1	7	Peritonitis.....	

SECOND SERIES.

Cow dry.

Cow No. 93. St. Elizabeth herd.

Age, 7 years; condition, good; number of calves, (?); breed, grade; origin, bought four years ago.

Physical examination, October 18, 1900: Pulse, 38; respiration, 20; temperature, 101°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.6°	103.6°
9 a. m.	100	105.4
12 m.	100.2	105.8
3 p. m.	101.9	104.7
6 p. m.	101.8	104.2

Postmortem, Rosslyn, Va., December 11, 1900: The right lung shows a few nodules in the cephalic lobe of a soft, cheesy character from one-third to 1 inch in diameter. The ventral lobe contains a tuberculous area about the size of a hen's egg, with disintegrated contents and surrounded by hyperemic tissue.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
76a	July 9 to Oct. 9	c. c. 80	Oct. 21	104	No lesions.....	
77a	July 9 to Oct. 6	80	Oct. 6	89	Not tuberculosis.....	
78a	July 9 to Oct. 9	80	Dec. 1	145	No lesions.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
165	Aug. 25	Milk.....	c. c. 2	Sept. 15	21	Not tuberculosis.....	
166	...do...	Cream.....	3	Nov. 2	69	No lesions.....	
167	...do...	...do.....	2	Nov. 4	71	...do.....	

SECOND SERIES.

1579	Oct. 20	Milk.....	5	Nov. 18	29	No marked lesions ...	
1580	...do...	...do.....	3	Dec. 17	58	No lesions.....	
1592	Oct. 22	Cream.....	5	Nov. 26	35	Not tuberculosis.....	
1593	...do...	...do.....	3	Dec. 13	52	No lesions.....	

Cow No. 94. St. Elizabeth herd.

Age, 8 years; condition, fair, losing flesh; number of calves, (?); breed, grade; origin, bought six months before test.

Physical examination, December 4, 1900: Pulse, 60; respiration, 24; temperature, 102.2°. Bad cough. Superficial lymph glands, normal. Lungs: Percussion, apparently normal; auscultation—right lung, râles posterior superior third; left lung, apparently normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.9°	103.6°
9 a. m.	102	105.6
12 m.	101.4	106.4
3 p. m.	101.6	105
6 p. m.	101.8	103.1

Postmortem, Rosslyn, Va., December 21, 1900: Greater portion of principal lobes of both lungs contain tubercular areas from size of a walnut to that of a hen's egg, of caseous consistence. Bronchial lymphatic glands are slightly enlarged and contain calcareous foci of tuberculous material from one-eighth to one-third inch in diameter.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
77a	July 9 to Oct. 9	c. c. 80	Oct. 27	110	Normal	
78a	do	80	Nov. 19	133	do	
79a	do	80	Dec. 12	156	do	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
152	Aug. 24	Milk	c. c. 3	Oct. 29	66	No lesions	
153	do	do	2	Oct. 28	65	Not tuberculosis	
154	do	Cream	3	Sept. 30	37	do	
155	do	do	2	Aug. 30	6	Hepatic abscess	Negative.

SECOND SERIES.

1594	Oct. 20	Milk	3	Dec. 12	53	No lesions	
1595	do	do	5	Dec. 17	58	do	
1596	do	Cream	5	Nov. 27	38	Not tuberculosis	
1597	do	do	3	Dec. 13	54	No lesions	

Cow No. 95. St. Elizabeth herd.

Age, 10 years; condition, thin and delicate; number of calves, (?); breed, common; origin, bought three years ago.

Physical examination, September 19, 1900: Pulse, 41; respiration, 24; temperature, 101.8°. Superficial lymph glands, normal. Lungs: Percussion, normal; auscultation, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.6°	101.6°
9 a. m.	102	103
12 m.	101	105
3 p. m.	100.7	105.9
6 p. m.	102.3	105.5

Postmortem, Rosslyn, Va., December 21, 1900: The caudal lobe of right lung contains 5 caseous nodules the size of walnuts, arranged in a cluster along the dorsal margin. Anterior and posterior mediastinal glands show a few miliary foci undergoing necrotic changes. Right retropharyngeal gland is enlarged and has completely undergone a cheesy degeneration.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
80a	July 9 to Oct. 7.....	c. c. 80	Oct. 7	90	Not tuberculosis	
81a	July 9 to Sept. 13.....	80	Sept. 13	66	Pneumonia	
82a	July 9 to Oct. 9.....	80	Oct. 20	103	Not tuberculosis	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
156	Aug. 24	Milk.....	c. c. 3	Oct. 15	52	Normal.....	
157	do.....	do.....	2	Oct. 26	63	do.....	
158	do.....	Cream.....	3	Nov. 3	71	do.....	
159	do.....	do.....	2	Sept. 23	30	Not tuberculosis.....	

SECOND SERIES.

1457	Oct. 20	Milk.....	5	Dec. 15	56	No lesions	
1590	do.....	do.....	5	Dec. 18	59	do.....	
1591	do.....	do.....	3	Dec. 26	67	do.....	
1600	Oct. 22	Cream.....	3	Jan. 24	94	do.....	
1601	do.....	do.....	5	Jan. 25	95	do.....	

Cow No. 96. St. Elizabeth herd.

Age, 6 years; condition, unthrifty; number of calves, 3; breed, Holstein; origin, raised.

Physical examination, October 25, 1900: Pulse, 42; respiration, 23; temperature, 102.6°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.....	102.1°	102.8°
9 a. m.....	101.8	105
12 m.....	101.6	106.1
3 p. m.....	102	106.6
6 p. m.....	102.8	105.4

Postmortem, Fowlers, D. C., April 12, 1901: Four caseous foci in principal lobe of left lung from the size of a walnut to a hen's egg. One area in posterior part of right principal lobe the size of a walnut containing gritty particles. One small focus of a cheesy nature one-fourth inch in diameter in right posterior pharyngeal gland.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
83a	July 9 to Oct. 9	c. c. 80	Dec. 12	156	Normal	
84a	do.....	80	Nov. 9	123	do.....	
85a	do.....	80	Nov. 10	124	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
144	Aug. 23	Milk.....	c. c. 3	Nov. 22	91	Normal.....	
145	do.....	do.....	2	Oct. 12	50	do.....	
146	do.....	Cream.....	3	Sept. 29	37	Not tuberculosis.....	
147	do.....	do.....	2	Sept. 23	31	do.....	

SECOND SERIES.

1603	Oct. 22	Milk.....	3	Dec. 9	48	Normal.....	
1604	do.....	Cream.....	5	Nov. 25	34	Not tuberculosis.....	
1605	do.....	do.....	3	Nov. 3	12	Hepatic abscess.....	Negative.

Cow No. 97. St. Elizabeth herd.

Age, 6 years; condition, good; number of calves, 3; breed, Holstein; origin, raised.

Physical examination, October 10, 1900: Pulse, 38; respiration, 21; temperature, 101.8°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	102. 1°	107°
9 a. m.	101. 8	107. 5
12 m.	101. 8	106
3 p. m.	102	107. 2
6 p. m.	102. 2	104

Postmortem, Fowlers, D. C., April 12, 1901: Several caseous nodules, three-fourths to 2½ inches in diameter in principal lobes of both lungs having thick, strong encapsulating walls. Right bronchial gland is greatly enlarged, and contains a disintegrated mass of tuberculous material.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
86a	July 9 to Aug. 12	c. c. 80	Aug. 12	34	No marked lesions.....	
87a	July 9 to Oct. 9	80	Oct. 19	102	Not tuberculosis.....	
88a	July 9 to Aug. 6	80	Aug. 6	28	Ruptured stomach.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
148	Aug. 23	Milk.....	c. c. 3	Dec. 17	116	Normal.....	
149	do....	do....	2	Aug. 29	6	Abscess at point of inoculation.	
150	do....	Cream.....	3	Sept. 6	14	No lesions.....	
151	do....	do....	2	Sept. 27	35	Not tuberculosis.....	

SECOND SERIES.

1607	Oct. 22	Milk.....	3	Dec. 20	59	Pneumonia.....	Negative.
1608	do....	Cream.....	5	Oct. 24	2	Septicemia.....	
1609	do....	do....	3	Jan. 9	79	No lesions.....	

Cow No. 98. St. Elizabeth herd.

Age, 7 years; condition, good; number of calves, 4; breed, Holstein; origin, raised.

Physical examination, October 25, 1900: Pulse, 38; respiration, 20; temperature, 102.1°. Superficial lymph glands, normal. Lungs: Percussion, apparently normal; auscultation, right lung, apparently normal; left lung, apparently normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.9°	103°
9 a. m.	101.8	104.6
12 m.	101.6	105.3
3 p. m.	101.8	105.6
6 p. m.	102.2	102.9

Postmortem, Fowlers, D. C., April 12, 1901: The lungs are filled with tuberculous nodules that have become confluent in both caudal and the left cephalic lobes. In the left caudal lobe a large abscess cavity is seen that involves a large bronchus. The mucous membrane of the trachea contains two or three tuberculous ulcers and nodules from the size of a dime to that of a half dollar. The anterior and posterior mediastinal glands are greatly swollen and show caseous degeneration. The tonsils are also enlarged and contain caseous material. One nodule under the mucous membrane on the posterior superior surface of the tongue was found tuberculous on microscopic examination.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
89a	July 9 to Oct. 9	c. c. 80	Nov. 13	127	Not tuberculosis.....	
90a	do....	80	Nov. 19	133	Normal.....	
91a	do....	80	do....	133	do....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
168	Aug. 27	Milk.....	c. c. 3	Sept. 21	25	Not tuberculosis.....	Negative.
169	do.....	do.....	2	Nov. 6	71	No lesions.....	
170	do.....	Cream.....	3	Sept. 26	30	Not tuberculosis.....	
171	do.....	do.....	2	Sept. 15	19	Hepatic abscess.....	

SECOND SERIES.

1611	Oct. 22	Milk.....	3	Dec. 15	54	No lesions.....	Positive. Do.
1681	do.....	do.....	5	Nov. 26	35	Tuberculosis.....	
1682	do.....	Cream.....	3	Nov. 24	33	do.....	

Cow No. 99. St. Elizabeth herd.

Age, 7 years; condition, good; number of calves, 4; breed, Holstein; origin, raised.

Physical examination, October 10, 1900: Pulse, 52; respiration, 21; temperature, 101.8°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.8°	104°
9 a. m.	102	105
12 m.	101.4	103.4
3 p. m.	101.8	103.4
6 p. m.	102.5	101.4

Postmortem, Rosslyn, Va., February 1, 1901: Posterior portion of principal lobe of right lung contains one large tuberculous region 5 inches long by 3 inches wide, which protrudes as if separated by a retaining band from the normal lung tissue. The contents are completely degenerated and semifluid in consistence. The trachea shows four circumscribed abscesses the size of shellbarks along its external anterior border following the course of the lymphatic vessels, and a suppurating ulcer on the mucous membrane. Both retropharyngeal glands are enlarged, the left containing three necrotic centers, while the right is completely degenerated and gritty on section. The right bronchial gland is the size of a duck's egg and likewise calcified. Several retention cysts in the udder.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
92a	July 9 to Oct. 9.....	c. c. 80	Nov. 2	116	Not tuberculosis.....	
93a	do.....	80	Nov. 7	121	do.....	
94a	do.....	80	Dec. 21	165	Normal.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
132	Aug. 21	Milk.....	c. c. 3	Nov. 1	72	Normal.....	
133	do	do.....	2	Sept. 28	38	Pneumonia.....	
134	do	Cream.....	3	Oct. 16	56	Normal.....	
135	do	do.....	2	Oct. 22	62	do.....	

SECOND SERIES.

1643	Oct. 24	Milk.....	5	Dec. 20	57	Normal.....	
1644	do	do.....	3	Jan. 10	78	do.....	
1645	do	Cream.....	5	Jan. 17	85	do.....	
1646	do	do.....	3	Nov. 19	26	Not tuberculosis.....	

Cow No. 100. St. Elizabeth herd.

Age, 7 years; condition, good; number of calves, (?); breed, grade; origin, bought three years ago.

Physical examination, September 11, 1900: Pulse, 38; respiration, 20; temperature, 101°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.6°	101.7°
9 a. m.	101.3	102.2
12 m.	101.2	104.1
3 p. m.	101.2	103.9
6 p. m.	101.7	102.6

Postmortem, Fowlers, D. C., April 12, 1901: The principal lobe of left lung contains a caseous tuberculous focus three-fourth inch in diameter, surrounded by hyperplastic tissue. Both right and left bronchial glands are enlarged, and show three or four tubercular foci about one-fourth inch in diameter, undergoing calcification.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
95a	July 9 to Oct. 9	c. c. 80	Dec. 17	161	No lesions.....	
96a	do.....	80	Dec. 15	159	do.....	
97a	do.....	80	Dec. 26	170	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
			c. c.				
136	Aug. 21	Milk	3	Sept. 16	26	Not tuberculosis.....	
137	do....	do.....	2	Nov. 20	91	No lesions	
138	do....	Cream	3	Sept. 4	14	Not tuberculosis.....	
140	do....	do.....	2	Nov. 24	95	No lesions	

SECOND SERIES.

Cow dry.

Cow No. 102. St. Elizabeth herd.

Age, 7 years; condition, poor; number of calves, 3; breed, Holstein; origin, raised.

Physical examination, September 30, 1900: Pulse, 64; respiration, 27; temperature, 101.8°. Superficial lymph glands, normal. Lungs: Percussion, right lung, areas of dullness, left lung, slight dullness over superior portion posterior lobe; auscultation, right lung, absence of breath sounds posterior inferior part, left lung, small sibilant râles surrounding areas of silence.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	100.8°	103.7°
9 a. m.	101.1	105.4
12 m.	101.3	105.1
3 p. m.	102.4	104.6
6 p. m.	102.9	104.7

Postmortem, Rosslyn, Va., December 21, 1900: The parenchyma of both lungs is permeated with numerous isolated and confluent tubercular areas varying from the size of a hemp seed to a large lemon, with caseous contents. All the nodes of the mediastinal chain are enlarged and contain caseous and calcareous material. Posterior part of pleura, both sides of diaphragm, and anterior part of peritoneum are studded with fresh tubercular excrescences. Liver is covered with tubercular nodules extending into parenchyma. Majority of mesenteric glands show tubercular foci from one-eighth to one-half inch in diameter, some caseous, others calcareous.

Microscopic examination of centrifugal sediment of milk, positive; of cream positive.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
		c. c.				
99a	July 9 to Aug. 30 ...	120	Aug. 30	52	Tuberculosis	Positive.
100a	July 9 to Oct. 9	120	Oct. 17	100	do.....	Do.

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
100	Aug. 17	Cream	c. c. 3	Aug. 21	4	Peritonitis	Positive.
101	do	do	2	Dec. 27	132	No lesions	
102	do	Milk	3	Sept. 23	37	Tuberculosis	
103	do	do	2	Aug. 21	4	Peritonitis	

SECOND SERIES.

1647	Oct. 24	Milk	5	Nov. 23	30	Tuberculosis	Positive.
1648	do	do	3	Nov. 22	29	do	Do.
1649	do	Cream	5	Dec. 14	51	do	Do.
1650	do	do	3	Dec. 18	55	do	Do.

Cow No. 103. St. Elizabeth herd.

Age, 5 years; condition, fair; number of calves, 2; breed, Holstein; origin, raised.

Physical examination, September 11, 1900: Pulse, 50; respiration, 28; temperature, 101.9°. Glands: Submaxillaries, enlarged; supramammary, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101°	102.6°
9 a. m.	101.1	106.2
12 m.	101.6	107
3 p. m.	101.4	106.2
6 p. m.	102.8	105.6

Postmortem, Rosslyn, Va., February 1, 1901: The lungs show six or seven tuberculous areas, from the size of a pea to a pigeon's egg, scattered throughout the parenchyma. The posterior mediastinal glands contain four calcareous foci the size of hazelnuts well encapsulated. Both bronchial and anterior mediastinal glands show degenerated foci from one-eighth to one-half inch in diameter. Both submaxillary glands completely degenerated and the size of walnuts.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
101a	July 9 to Oct. 9	c. c. 120	Nov. 3	117	Normal	
102a	do	120	Dec. 11	155	do	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
104	Aug. 17	Cream	c. c. 3	Sept. 15	29	Chronic peritonitis...	
105	...do...	...do	2	Nov. 19	94	Normal	
106	...do...	Milk	3	Oct. 1	45	...do	

SECOND SERIES.

1651	Oct. 24	Milk	5	Dec. 12	49	No lesions	
1652	...do...	...do	3	Dec. 17	54	...do	
1653	...do...	Cream	5	Jan. 11	79	...do	
1654	...do...	...do	3	Jan. 23	91	...do	

Cow No. 104. St. Elizabeth herd.

Age, 4 years; condition, good; number of calves, 2; breed, Holstein; origin, raised.

Physical examination, October 25, 1900: Pulse, 48; respiration, 24; temperature, 102.6°; M. M., normal; udder, palpation normal. Glands: Submaxillary, normal; supramammary, normal. Lungs: Percussion, apparently normal; auscultation, apparently normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	101.4°	104.8°
9 a. m.	101.8	106.9
12 m.	101	107.2
3 p. m.	101.4	106.8
6 p. m.	102.3	103

Postmortem, Rosslyn, Va., December 11, 1900: Apex of right lung contains a yellow caseous nodule the size of a walnut, well encapsulated. Left caudal lobe has four tuberculous areas from the size of a shellbark to an egg, which contain calcareous material. Great many grape-like clusters are sprinkled over entire left pleura and anterior surface of diaphragm. Right and left bronchial and anterior and posterior mediastinal glands are enlarged and degenerated with caseous contents. Left prepectoral gland of normal size, but shows three small necrotic foci. Left posterior pharyngeal gland slightly enlarged and undergoing cheesy degeneration. Liver shows numerous angiomas, otherwise normal.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
103a	July 9 to Sept. 12 ...	c. c. 60	Sept. 12	65	Tuberculosis	Positive.
104a	July 9 to Oct. 9	60	Nov. 26	140	Normal	
105a	...do	60	Nov. 18	132	...do	
106a	...do	60	Oct. 26	109	Tuberculosis	Do.

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
124	Aug. 21	Milk.....	c. c. 3	Sept. 24	34	Tuberculosis	Positive.
125	do	do	2	Sept. 4	14	Pneumonia.....	Negative.
126	do	Cream.....	3	Nov. 28	99	No lesions	
127	do	do	2	Nov. 27	98	do	

SECOND SERIES.

1655	Oct. 24	Milk.....	5	Dec. 20	57	No lesions	
1656	do	do	3	Dec. 18	55	do	
1657	do	Cream.....	5	Jan. 4	72	do	
1650	do	do	3	Dec. 7	44	do	

Cow No. 105. St. Elizabeth herd.

Age, 9 years; condition, poor; number of calves, (?); breed, Holstein; origin, bought four years ago.

Physical examination, September 11, 1900: Pulse, 50; respiration, 23; temperature, 101°. Superficial lymph glands, normal. Lungs, apparently normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m	101.2°	104.2°
9 a. m	100.8	105.3
12 m	101.4	105.3
3 p. m	102.3	104.5
6 p. m	102.9	105

Postmortem, Rosslyn, Va., December 21, 1900: Parenchyma of both lungs studded with tuberculous nodules varying in size from one-half to 1½ inches in diameter. Costal pleura covered with isolated and confluent grape-like masses of tuberculous nature. These new formations are about one-half inch thick on the diaphragm, and seem of recent origin. The prepectoral glands show three caseous foci, one-fourth to three-eighths inch in diameter. Anterior and posterior mediastinal glands contain several hempseed-like areas that are calcareous.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
107a	July 9 to Oct. 9	c. c. 80	Dec. 18	162	No lesions	
108a	do	80	Oct. 12	95	No marked lesions.....	
109a	do	80	Oct. 31	114	No lesions	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
128	Aug. 21	Milk.....	c. c. 3	Aug. 26	5	Peritonitis	
129	do....	do....	2	Oct. 3	43	Normal.....	
130	do....	Cream.....	3	Aug. 25	4	Peritonitis.....	
131	do....	do....	2	Oct. 25	65	No lesions.....	

SECOND SERIES.

1659	Oct. 24	Milk.....	5	Dec. 24	61	Hepatitis.....	Negative.
1660	do....	do....	3	Jan. 12	80	Normal.....	
1661	do....	Cream.....	5	do....	80	do....	
1662	do....	do....	3	Dec. 18	55	do....	

Cow No. 106. St. Elizabeth herd.

Age, 6 years; condition, good; number of calves, 3; breed, Jersey; origin, raised.

Physical examination, December 4, 1900: Pulse, 46; respiration, 18; temperature, 102.2°. Hard fibrous tumor of actinomycosis on left lower jaw. Superficial lymph glands, normal. Lungs: Percussion, right lung, posterior third dull, left lung, apparently normal; auscultation, right lung, many mucous râles and loss of sound, left lung, apparently normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.....	101.3°	104.2°
9 a. m.....	101.8	106.2
12 m.....	100.8	106.3
3 p. m.....	101.5	106.3
6 p. m.....	101.2	104.5

Postmortem, Rosslyn, Va., December 17, 1900: Actinomycotic tumor the size of one's fist on left side of inferior maxilla involving the bone. No fistula could be found. Right retropharyngeal gland enlarged and contains caseous tubercular material. Posterior mediastinal and bronchial glands contain several tubercular foci. Posterior part of caudal lobe of right lung transformed into a tubercular mass. Two caseous foci in the ventral lobe the size of walnuts. Main lobe of left lung contains three or four degenerated areas from one-half to 1 inch in diameter.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
110a	July 9 to Sept 8.....	c. c. 80	Sept. 8	61	Not tuberculosis	
111a	July 9 to Aug. 31....	80	Aug. 31	53	do.....	
112a	July 9 to Oct. 9.....	80	Nov. 28	142	No lesions.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
116	Aug. 18	Milk.....	c. c. 3	Dec. 15	119	No lesions	
117	do....	do....	2	Sept. 29	42	Not tubercular	
118	do....	Cream.....	3	Oct. 1	44	do....	
119	do....	do....	2	Oct. 5	48	do....	

SECOND SERIES.

1663	Oct. 24	Milk.....	5	Nov. 23	30	No lesions	
1664	do....	do....	3	Dec. 19	55	do....	
1722	Oct. 25	Cream.....	5	Dec. 22	58	do....	
1723	do....	do....	3	Dec. 18	54	do....	

Cow No. 108. St. Elizabeth herd.

Age, 8 years; condition, good; number of calves, 4; breed, Holstein; origin, raised.

Physical examination, September 11, 1900: Pulse, 56; respiration, 23; temperature, 101.3°. Glands: Left submaxillary, size of walnut; supranammary, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a.m.	101.6°	102.2°
9 a.m.	100.9	103.1
12 m.	102	105.2
3 p.m.	101.2	105.9
6 p.m.	102.4	104.6

Postmortem, Rosslyn, Va., December 17, 1900: On the dorsal margin of the left principal lobe is an irregular cluster of tubercular nodules in varying stages of degeneration, measuring from 2 to 3 inches in diameter. The main lobe of the right lung contains a nodule the size of a silver dollar that contains a semicalcareous material. The right bronchial gland shows five similar foci, while the entire mediastinal chain of lymph glands present numerous small firm tubercles, some showing caseation, others calcification.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
116a	July 9 to Oct. 9	c. c. 80	Nov. 30	144	No lesions.....	
117a	do....	80	Dec. 4	148	do....	
118a	do....	80	Jan. 9	181	do....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
120	Aug. 18	Milk.....	c. c. 3	Sept. 6	19	Pneumonia.....	
121	do.....	do.....	2	Nov. 5	79	No lesions.....	
122	do.....	Cream.....	3	Nov. 23	97	do.....	

SECOND SERIES.

1667	Oct. 25	Milk.....	5	Nov. 23	29	Hepatitis.....	Negative.
1668	do.....	do.....	3	Jan. 6	73	No lesions.....	
1669	do.....	Cream.....	5	Jan. 3	70	do.....	
1670	do.....	do.....	3	Oct. 27	2	Septicemia.....	

Cow No. 109. St. Elizabeth herd.

Age, 7 years; condition, rather poor; number of calves, 4; breed, grade Holstein; origin, raised.

Physical examination, October 18, 1900: Pulse, 38; respiration, 22; temperature, 101.9°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a.m.....	100.9°	101.8°
9 a.m.....	101	105
12 m.....	101.1	105.7
3 p.m.....	101.2	105.8
6 p.m.....	102.1	104.5

Postmortem, Fowlers, D. C., May 15, 1901: The parietal and pulmonary pleura are studded with numerous tuberculous neoplasms more or less confluent, forming what is commonly known as pearl disease. The ventral lobe of right lung contains a caseous area 2 inches in diameter opening into a bronchial tube. The mucous membrane of the trachea about 5 inches from its bifurcation shows a tuberculous ulcer. Three inches anterior to this are seen two other ulcers that have become confluent.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
128a	July 9 to Oct. 9.....	c. c. 80	Nov. 12	126	Normal.....	
129a	do.....	80	Nov. 21	135	do.....	
130a	do.....	80	Nov. 10	124	do.....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection.	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
108	Aug. 14	Cream	c. c.	Nov. 27	105	Normal	
109	do....	do....	3	Nov. 1	79	do....	
110	do....	Milk	2	Sept. 5	22	Not tuberculosis	
111	do....	do....	3	Oct. 15	62	Normal	

SECOND SERIES.

1671	Oct. 25	Milk	5	Jan. 3	70	Normal	
1672	do....	do....	3	Jan. 5	72	do....	
1673	do....	Cream	5	Jan. 27	93	do....	
1674	do....	do....	3	do....	93	do....	

Cow No. 112. St. Elizabeth Herd.

Age, 6 years; condition, good; number of calves, 3; breed, Holstein; origin, raised.

Physical examination, October 18, 1900: Pulse, 48; respiration, 26; temperature, 101.3°. Superficial lymph glands, normal. Lungs, normal.

Tuberculin test.

Hour.	May 2, 1900. Before injection.	May 3, 1900. After injection.
6 a. m.	100.6°	102°
9 a. m.	101.2	103.1
12 m.	101	102.8
3 p. m.	101.5	105.6
6 p. m.	102	104.5

Postmortem, Fowlers, D. C., May 15, 1901: Few small caseous foci about one-fourth inch in diameter in principal lobe of right lung. Right bronchial gland slightly enlarged and contains two or three centers of caseous material. Posterior mediastinal glands are slightly enlarged with several caseated foci the size of a pea.

Microscopic examination of centrifugal sediment of milk, negative; of cream, negative.

Feeding experiments.

Guinea pig No.	Duration of experiment.	Amount fed daily.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
158a	July 9 to Oct. 9	c. c.	Nov. 15	129	No lesions	
159a	do....	80	Dec. 27	171	Not tuberculosis	
160a	do....	80	Oct. 27	110	do....	

Inoculation experiments.

FIRST SERIES.

Guinea pig No.	Date of injection	Material.	Dose injected.	Date when killed or died.	Number of days alive.	Postmortem diagnosis.	Microscopic examination of lesions.
112	Aug. 17	Cream	c. c. 3	Sept. 1	15	Not tuberculosis.....	
113	...do...	...do	2	Sept. 23	37	...do	
114	...do...	Milk	3	Sept. 21	35	Rupture of cecum	
115	...do...	...do	2	Nov. 14	89	No lesions	

SECOND SERIES.

1675	Oct. 25	Milk	5	Nov. 23	29	Not tuberculosis.....	
1676	...do...	...do	3	Nov. 30	36	...do	
1677	...do...	Cream	5	Nov. 16	22	Hepatic abscess	Negative.
1678	...do...	...do	3	Dec. 15	51	No lesions	

In order to show more conveniently and also more vividly the positive results obtained from those cows that were found to be excreting tubercle bacilli in the milk, the following synthetical table is appended:

Summary of cows secreting tuberculous milk, with the results of microscopic examination.

Number of cow.	Lesions of guinea pig fed.	Centrifugalized milk.	Centrifugalized cream.	Lesions of guinea pig injected, first series.	Lesions of guinea pig injected, second series.
4	Positive	Negative	Negative	Positive	Negative.
10	Negative	Positive	...do	Negative	Do.
12	...do	Negative	...do	...do	Positive.
15	Positive	...do	...do	Positive	Negative.
64	Negative	...do	...do	...do	Positive.
65	Positive	Positive	Positive	Negative	Do.
71	...do	Negative	Negative	...do	Do.
73	...do	...do	...do	...do	Do.
74	...do	...do	...do	...do	No inoculation.
77	...do	Positive	...do	Positive	Do.
98	Negative	Negative	...do	Negative	Positive.
102	Positive	Positive	Positive	Positive	Do.
104	...do	Negative	Negative	...do	Negative.

The above synopsis of positive results obtained from the feeding and inoculation experiments, as well as from the microscopic examination of the centrifugalized sediment of milk and cream, indicates that one or more of the guinea pigs fed with milk from 9 different cows have succumbed with typical tuberculosis; that is, the milk of 16.07 per cent of the 56 reacting cows has been found to be pathogenic to guinea pigs when fed to them. Of the experimental animals inoculated intraabdominally in the first series, at least 1 guinea pig has died of tuberculosis in each of 6 different instances, showing that the milk of 10.9 per cent of the 55 reacting cows in this experiment has proven fatal to guinea pigs in the first inoculation experiment. In the second series of intraabdominal injections the milk from 7 individual cows out of 45 examined, or 15.5 per cent, was demonstrated to possess virulent tubercle bacilli. By uniting these inoculation results it will be observed that 11 out of 55 cows, or 20 per cent, secreted milk which

transmitted tuberculosis to one or more experimental animals when injected into the peritoneal cavity.

Owing to the greater percentage of positive results obtained from the second inoculation experiment, conducted more than two months after the first intraabdominal test, it appears probable, as would be expected, that the virulence of milk increases with the advancement of the disease in the cow. The lack of uniformity of results obtained in many of the cows might be explained from our knowledge that tubercle bacilli are not excreted by the normal udder with any degree of constancy. For this reason the continuous feeding experiment, covering a period of three months, seems to have more practical value in demonstrating the transmission of tuberculosis than the inoculation test, where the only possibility of affirmative results must depend on the contingency of the accidental excretion of the bacilli on one particular day.

The combined results of the ingestion and inoculation experiments show that the milk of 12 out of 56 reacting cows, or 21.4 per cent, has at one time or another since the beginning of the experiment contained virulent tubercle bacilli.

Cover-glass preparations of the centrifugalized sediment of milk from 4 out of 55 cows, or 7.2 per cent, revealed the presence of the tubercle bacillus, and in 2 of these cases the centrifugalized cream was also found to possess this organism. In one case (cow No. 10) tubercle bacilli were demonstrated only by microscopic examination of the centrifugalized milk sediment. The number observed was very scarce, 3 in one slide and but 1 in another, while the remaining 9 cover glasses were apparently free from this bacillus. It appears singular that positive results were not obtained by the intraabdominal injection of this sediment from which the cover glasses showing the tubercle bacilli were made. Wyssokowitsch in his experiments regarding the quantity of bacilli requisite for the production of tuberculosis by injection into the peritoneal cavity, found that it required at least 30 bacilli for the transmission of the disease. Granting this conclusion, it is evident that the milk injected either did not contain a sufficient number of bacilli to cause the disease or that the bacilli were less vigorous or the guinea pigs more resistant than in the other experiments. It is also of interest to know that of the guinea pigs that succumbed to tuberculosis as a result of intraabdominal inoculation, 7 were injected with a mixture of milk and cream, 5 with centrifugalized cream alone, and the remaining 8 with the milk sediment.

With one cow (No. 102) positive results were obtained in all the tests—that is, by ingestion, by inoculation, and by microscopic examination of the sediment of the milk and cream—although but 7 of the 10 experimental animals fed and inoculated with the milk of this cow became tubercular. At the beginning of the investigation the cow

was in apparently good condition, but late in September stethoscopic râles could occasionally be heard which gradually became more perceptible. She became unthrifty, fell off in flesh, and gave strong clinical evidence of tuberculosis. Early in September mucous râles were observed by auscultation of the lungs of cow No. 65. A similar unthriftiness and loss of flesh were observed as noted in the previous animal and before the experiment was concluded she was a mere skeleton. With these exceptions, the cows from which positive results were obtained appeared in good condition without manifesting any clinical symptoms of tuberculosis while the experiment was being conducted. During this period a physical examination of all the cows was made on frequent occasions and the first evidence of clinical symptoms has been noted in the physical examination described in the preceding tables (pp. 26 to 78). In comparing the virulence of the milk with the extent of the postmortem lesions found in the cows, the latter may be arranged in three classes. The first group would include those animals that have shown physical evidences of tuberculosis during the experiment and would embrace cows Nos. 65 and 102. The second group comprises the cattle in which the postmortem lesions were extensive, and generalized, but in which no apparent physical symptoms could be observed during the experiment, and includes cows Nos. 10, 12, 15, 64, 71, 73, 74, and 77. In the third class the lesions were found to be extensive but confined to the respiratory tract and contains cows Nos. 4, 98, and 104.

It is with the last two classes of cows which are in apparently good condition, but which occasionally excrete tubercle bacilli, that the great danger remains hidden and which demands that all milk from tubercular cows should be sterilized before using. The lesions of tuberculosis were in the majority of cases of such a nature that a short prolongment of their lives might probably have placed them in the first group.

Moreover, from a review of the postmortem notes it will be seen that some cows which gave negative results in the milk experiments were as markedly diseased as some that gave positive results. This is of interest in showing the great uncertainty attached to the intelligent selection of cows producing tuberculous milk by any method other than the unfeasible one of microscopic examination, or what is far better, though equally impracticable, the animal inoculations of the milk from each individual cow. And it likewise indicates the danger involved in drawing conclusions from experiments with a few cattle such as would include these negative cases to the exclusion of others no more diseased but nevertheless secreting infectious milk.

It should also be remembered, in comparing the disease found on postmortem examination with the virulence of the milk secreted, that the cows were permitted to live from two to thirteen months following the investigation, and it is but logical to presume that, on the whole,

the disease was less marked at the time of the experiment than on the date of the postmortem.

Specimens of the mammary glands from all the above-mentioned cows were brought to the laboratory and histological examination made, but without finding any indication of tuberculosis. Special attention was given to the udder of cow No. 102, and numerous serial sections were examined with entirely negative results.

Owing to the uncertainty of diagnosing the extent of tuberculosis in a reacting animal, the impossibility of saying at what moment a latent, incipient, or localized infection may develop into a generalized or extensive case with probable involvement of the mammary gland, and to the further fact that it is difficult to recognize the beginning of tuberculosis in the udder, it behooves one to look at least with suspicion upon the milk of all tuberculous cows. It is a strongly suggestive fact that many cases of tuberculosis of the supramammary lymph glands in which there may be no evident udder lesion can hardly be explained without assuming that the bacilli had entered from the lymphatics of the mammæ. Furthermore the great prevalence and constant increase of tuberculosis among hogs fed upon the by-products from dairies and creameries point forcibly to the milk as the means by which the disease is transmitted and disseminated. It may also be worth mentioning in this connection that Bang considers it possible for milk to retain its normal appearance for at least a month after the udder shows tuberculous involvement.

The result of this investigation demonstrated fully the necessity for thorough sterilization of the milk from reacting cows before it was consumed as food, and precautions of this nature were at once observed by the asylum authorities. The danger to the consumer of this raw milk seems palpable, although it is not assumed to be in direct proportion to the positive results obtained in such susceptible animals as guinea pigs.

SUPPRESSION AND ERADICATION.

In dealing with the question of the eradication of tuberculosis from this herd in order to obtain a permanent supply of hygienic milk, several courses were possible of adoption, and they were presented to the superintendent of the asylum, as follows:

The quickest and most radical method would be to destroy all of the affected animals and to substitute fresh tuberculin-tested cows. This would, however, involve a great and immediate outlay of money and would necessitate a thorough disinfection and partial reconstruction of the present premises. It would also require constant vigilance and semiannual tuberculin tests in order to discover incipient cases of tuberculosis and to eliminate them before they become dangerous to the health of the remaining animals.

Another method would be to dispose of those animals whose milk had been found to contain virulent tubercle bacilli and to retain the remainder of the reacting cows for breeding and dairy purposes. All calves born from these cows should then be

tested with tuberculin shortly after birth, and, when found free from the disease, should be removed to the stable in which the nonreacting cows are kept and be brought up on sterilized milk or on milk from nonreacting cows. In this case it would only be necessary to substitute the 13 above-mentioned cows that were secreting tuberculous milk with tuberculin-tested animals. The sterilization of the milk from the reacting cows should, however, be continued, and constant veterinary supervision would be required for the purpose of eliminating cases which on physical examination are judged to have passed from the incipient into a dangerous stage.

Finally, the present condition might be allowed to continue and only such cows be disposed of which, in the opinion of the farm superintendent, did not pay for their keep. All newly born calves should be dealt with in the same manner as above described. This method of eradicating tuberculosis, known as the Danish method, has been found to be practical, but requires, under the best circumstances, four or five years.

In either of the two latter cases the greatest drawback is the necessity for keeping two distinct herds with separate attendants, implements, and dairy utensils. The premises at the asylum are, however, well adapted for the carrying out of either of these plans, there being two separate stables, each with an adjoining lot.

A fourth plan would be to turn the entire dairy department of the asylum over to a private party or syndicate, the asylum agreeing to pay a certain price per gallon for the milk, and the lessees to provide tuberculin-tested cows and to keep them under such sanitary conditions as the superintendent of the asylum would deem necessary in order to obtain a good quality of pure milk.

After due consideration of these various propositions by the asylum authorities, it was decided to adopt the first method of eradicating the disease. With this in view the animals in the infected barn were gradually slaughtered as they became dry until the herd had been reduced sufficiently to occupy but one-half of the stable. This portion of the stable was then boarded up tightly while the other half was being torn out and reconstructed. The entire floor, as well as the supporting beams, were replaced; new windows were located along the sides, and every painstaking effort was directed toward the production of a strictly hygienic stable. Individual mangers and stanchions were constructed and the entire woodwork, with the exception of the floor, was given two coats of paint. This thoroughness in cleaning out the possible danger of reinfection was likewise adopted in renovating the other half of the stable after the last tuberculous animal had been slaughtered.

As already stated, it was decided to concentrate the expense connected with the eradication of such an extensive infection in the herd and dispose of all the reacting cows. In all cases the cows were sold to local butchers, subject to the postmortem examination of the District health officer. Only the carcasses of those animals in which the disease was localized or in an incipient stage were passed as fit for food. Brief notes regarding the history and postmortem examination of the cows reacting to the first tuberculin test, but not in the milk experiment, follow:

Cow No. 21.—Grade, Holstein; 5 years old; raised; in good condition; weight, 910 pounds.

Postmortem at Fowlers, D. C., April 8, 1901: Three small nodules of caseous material in each posterior pharyngeal gland. One small focus in right bronchial gland. Carcass passed.

Cow No. 22.—Red; common stock; 7 years old; bought two years ago; apparently in normal condition; weight, 840 pounds.

Postmortem at Fowlers, D. C., April 4, 1901: One small focus in right retropharyngeal gland. One nodule, size of a pigeon's egg, in right cephalic lobe and four foci, containing cheesy deposit, in ventral lobe of left lung. Carcass passed.

Cow No. 23.—Black Holstein heifer; 3 years old; raised; in fair condition; weight, 610 pounds.

Postmortem at Rosslyn, Va., March 8, 1901: Left lung contains a number of small foci in posterior portion of ventral lobe. Posterior mediastinal gland considerably enlarged and contains three or four encysted foci that have undergone calcareous degeneration. Carcass passed.

Cow No. 24.—Dark brindle; 9 years old; purchased three years ago; in ordinary condition; weight, 970 pounds.

Postmortem at Rosslyn, Va., February 1, 1901: Right bronchial lymph gland greatly enlarged and degenerated. Entire posterior mediastinal chain of glands contains nodules. Right lung shows caseous areas throughout entire parenchyma. Left lung contains four or five foci, principally in ventral lobe. Liver has three tuberculous foci about the size of a hazelnut in the parenchyma and several neoplasms adhering to the capsule. One mesenteric gland contains two pea-sized foci. The right anterior quarter of the udder on cross section appears indurated and knotty with miliary foci and yellowish lines of tuberculous material following the course of the lacteals. The mucous membrane of the milk cistern contains several tubercles, but the supramammary lymph glands are apparently not involved. A microscopic examination of cover-glass preparations made from the udder shows tubercle bacilli. Carcass condemned.

Cow No. 25.—Holstein grade; 7 years old; raised; has been a good feeder, but going back recently; weight, 960 pounds.

Postmortem at Rosslyn, Va., February 1, 1901: Right lung has a focus in its apex the size of a pea. Right bronchial gland enlarged and caseous. Posterior mediastinal gland contains several miliary foci of caseous material. Liver shows three large caseous abscesses, size of a hen's egg and containing putrid pus. Spleen is adherent by dense fibrous tissue to the paunch and contains an abscess with foul-smelling contents. Large fibrous mass attached to diaphragm and paunch is also seen in which a foreign body is embedded. Carcass condemned.

Cow No. 26.—Holstein heifer; 2 years old; raised; in good condition; weight, 690 pounds.

Postmortem at Rosslyn, Va., February 1, 1901: Six or seven mesenteric glands enlarged and contain a number of foci in various stages of degeneration. Mucous membrane of the intestinal tract normal. Liver normal. Carcass passed.

Cow No. 27.—Red heifer; 3 years old; raised; no evidence of tuberculosis on physical examination, but animal has not been doing well; weight, 615 pounds.

Postmortem at Rosslyn, Va., February 1, 1901: Posterior mediastinal glands greatly enlarged and filled with calcareous material. Right bronchial gland has several calcareous foci. Numerous miliary tubercles in apex of right lung. Carcass condemned.

Cow No. 28.—Holstein grade; 5 years old; raised; in good flesh and thrifty; weight, 870 pounds.

Postmortem at Rosslyn, Va., February 1, 1901: Several small foci about size of hazelnut in ventral lobe of left lung. Small tubercular nodule in posterior mediastinal gland. Carcass passed.

Cow No. 29.—Red buffalo; common stock; 7 years old; bought three years ago; poor feeder and falling off in flesh; weight, 735 pounds.

Postmortem at Rosslyn, Va., February 1, 1901: Large tubercular mass in caudal lobe of right lung which appears adherent to the diaphragm. Two small nodules are observed in the ventral lobe of left lung. Right bronchial gland enlarged and completely degenerated. Liver is studded with various-sized neoplasms. Several mesenteric glands enlarged and contain tuberculous areas. Carcass condemned.

Cow No. 30.—Red buffalo; common stock; 7 years old; bought three years ago; poor feeder and falling off in flesh; weight, 690 pounds.

Postmortem at Rosslyn, Va., February 1, 1901: Both anterior and posterior mediastinal glands enlarged and contain cheesy material. The right ventral lobe contains a large abscess filled with tuberculous pus, surrounding which are smaller nodules containing caseous matter. One of the nodes in the mesenteric chain is enlarged and shows an incipient focus. Carcass condemned.

RETEST OF TWENTY-SIX COWS IN DRY BARN.

Six months having elapsed since the nonreacting cows were placed under sanitary conditions in the renovated small barn, it was deemed advisable to again subject them to the tuberculin test in order to discover if tuberculosis had been latent in any of the cows at the time of the first injection. Of the 26 cows injected, 25 had failed to react in the previous test (see p. 9), while the remaining cow (No. 421) was near the end of the period of gestation at the time the first injection was made. The result of the second test (see below) shows that 8 of the previous nonreacting cows gave a decided reaction, while No. 421 failed to respond. These reacting animals were at once removed to the infected barn and the stalls previously occupied by them thoroughly cleaned and disinfected. As several were milking well they were not disposed of at once, but were continued in the dairy for varying periods and their milk thoroughly sterilized before using.

Retest of 26 cattle on November 25 and 26, 1900, which did not react when the entire St. Elizabeth herd was first tested, May 2 and 3, 1900. (a)

Number of cow.	Temperature taken.	6 a. m.	9 a. m.	12 m.	3 p. m.	6 p. m.	9 p. m.
No. 359.....	Nov. 25	102.0°	101.6°	101.8°	101.8°	101.1°	102.0°
	Nov. 26	101.4	101.2	100.2	101.4	101.0	100.4
No. 360.....	Nov. 25	101.2	101.2	101.0	101.7	101.2	101.2
	Nov. 26	101.4	101.0	101.2	100.6	101.2	101.0
No. 361.....	Nov. 25	102.5	102.6	102.2	101.2	101.0	101.4
	Nov. 26	102.0	101.8	102.0	102.9	102.7	102.5
No. 362.....	Nov. 25	101.6	101.5	102.3	102.3	101.6	101.9
	Nov. 26	104.7	105.8	107.0	106.7	106.0	106.4
No. 363.....	Nov. 25	102.0	101.6	101.8	101.8	101.9	101.6
	Nov. 26	102.1	103.6	105.7	106.3	105.6	105.2
No. 364.....	Nov. 25	102.0	101.8	101.6	101.8	101.4	101.6
	Nov. 26	102.9	104.2	106.9	106.6	105.6	105.3
No. 365.....	Nov. 25	100.8	102.0	101.6	101.8	102.0	102.0
	Nov. 26	101.7	101.6	101.4	102.0	102.4	103.0
No. 366.....	Nov. 25	101.4	101.2	101.0	101.4	100.6	102.0
	Nov. 26	101.5	101.1	101.4	102.0	102.4	103.0
No. 367.....	Nov. 25	102.0	101.8	101.4	101.2	101.5	101.6
	Nov. 26	101.6	101.5	101.4	101.4	101.4	101.2
No. 368.....	Nov. 25	101.6	101.5	101.0	101.4	102.0	101.0
	Nov. 26	101.5	101.4	101.0	101.6	101.5	101.4

^a Tuberculin injections made at 10 p. m., November 25.

Retest of 26 cattle on November 25 and 26, 1900, which did not react when the entire St. Elizabeth herd was first tested, May 2 and 3, 1900—Continued.

Number of cow.	Temperature taken.	6 a. m.	9 a. m.	12 m.	3 p. m.	6 p. m.	9 p. m.
No. 369.....	Nov. 25	101.5°	101.4°	101.6°	101.7°	101.4°	101.7°
	Nov. 26	101.6	101.6	101.6	101.7	101.6	101.3
No. 370.....	Nov. 25	102.0	100.6	101.4	101.3	100.7	100.6
	Nov. 26	101.5	101.5	101.6	101.7	101.0	101.2
No. 371.....	Nov. 25	100.6	101.0	100.6	100.0	102.0	100.2
	Nov. 26	101.2	101.4	101.4	102.5	102.2	101.6
No. 373.....	Nov. 25	102.0	101.7	101.4	102.2	100.6	101.2
	Nov. 26	101.3	101.4	101.8	105.0	105.7	104.6
No. 379.....	Nov. 25	101.5	101.6	101.4	101.4	101.5	101.0
	Nov. 26	102.5	101.2	101.2	101.2	101.8	101.5
No. 380.....	Nov. 25	103.2	102.2	101.4	100.5	101.0	101.2
	Nov. 26	102.7	102.8	105.2	104.1	103.0	103.3
No. 381.....	Nov. 25	101.7	102.0	101.6	101.5	101.2	101.8
	Nov. 26	101.8	101.5	101.5	101.6	101.4	102.4
No. 384.....	Nov. 25	102.0	101.5	101.4	101.4	101.0	101.3
	Nov. 26	102.6	104.6	105.6	106.2	106.0	104.8
No. 419.....	Nov. 25	101.6	101.8	101.4	101.4	100.6	101.0
	Nov. 26	103.0	104.8	105.8	105.2	103.6	103.0
No. 421.....	Nov. 25	101.6	101.7	101.5	100.8	101.5	101.4
	Nov. 26	101.4	101.5	101.2	101.2	101.6	101.0
No. 938.....	Nov. 25	101.5	100.0	100.9	100.8	101.0	101.2
	Nov. 26	101.4	101.0	100.8	101.2	101.0	100.8
No. 940.....	Nov. 25	102.2	102.0	102.0	101.8	101.0	101.2
	Nov. 26	102.0	102.0	101.5	101.6	102.0	101.0
No. 944.....	Nov. 25	102.0	101.8	101.3	101.7	101.2	101.4
	Nov. 26	101.7	101.7	102.9	103.9	104.3	103.6
No. 954.....	Nov. 25	101.2	101.5	101.1	101.2	99.6	100.8
	Nov. 26	101.2	101.6	101.8	102.0	102.0	100.4
No. 959.....	Nov. 25	101.3	101.3	101.5	101.6	100.4	101.0
	Nov. 26	102.0	101.7	101.4	101.3	103.2	102.6
No. 960.....	Nov. 25	101.8	102.2	101.4	101.5	100.4	101.6
	Nov. 26	102.3	101.9	101.8	102.2	101.8	101.2

It will be seen that 8 of the above cattle gave a decided reaction, and they were at once segregated and placed in quarantine in the infected barn. Owing to the decision that a nontuberculous herd should be established, these animals were slaughtered from time to time, and a brief description of the cows, together with postmortem notes, are given below.

Cow No. 362.—Roan Shorthorn grade; 6 years old; bought three years ago; weight, 1,090 pounds; in good flesh and apparently in healthy condition.

Postmortem at Rosslyn, Va., March 8, 1901: A number of small tuberculous nodules in the posterior mediastinal gland containing a calcareous deposit in the center. Large abscess in liver, not tuberculous. Carcass passed.

Cow No. 363.—Grade Jersey; 6 years old; purchased one year ago; weight, 790 pounds; animal in fair condition and apparently healthy.

Postmortem at Bennings, D. C., March 19, 1901: Caseous nodules about the size of an acorn in the anterior portion of the left ventral lobe. The udder shows a fibrous induration of the posterior quarters and both supramammary glands are enlarged and watery, but a subsequent microscopic examination did not reveal the presence of the tubercle bacillus. Carcass passed.

Cow No. 364.—Roan Shorthorn grade; dehorned; 5 years old; bought three years ago; weight, 1,035 pounds; aborted November 2, 1900. In thrifty condition, but shows an enlarged submaxillary gland.

Postmortem at Rosslyn, Va., March 6, 1901: Left submaxillary gland enlarged, the size of a hen's egg, containing caseous deposit with calcareous center. One small calcareous tubercle in the posterior mediastinal gland. Carcass passed.

Cow No. 373.—Spotted Ayrshire grade; 12 years old; raised; animal appears normal and in fair condition; weight, 840 pounds.

Postmortem at Bennings, D. C., March 19, 1901: Principal lobes of both lungs show a number of nodules ranging in size from a hazelnut to a walnut. On section they are seen to have undergone cheesy degeneration. Right posterior pharyngeal gland is greatly enlarged, with contents caseated. Posterior mediastinal glands contain several small yellowish tubercles of a softened consistency. Carcass condemned.

Cow No. 380.—Blue roan; common stock; 9 years old; purchased in Virginia about eighteen months ago; animal appears thrifty and is a good milker.

Postmortem at Fowlers, D. C., April 18, 1901: Three small caseated centers of tuberculosis in right posterior pharyngeal lymph gland. Right bronchial gland greatly enlarged and completely degenerated. Contains a cheesy detritus with center slightly calcified. Carcass passed.

Cow No. 384.—Grade Shorthorn; 8 years old; bought three years ago; condition good; weight, 1,015 pounds.

Postmortem at Fowlers, D. C., May 19, 1901: The posterior mediastinal glands are enlarged and contain several soft, yellowish tubercles, varying from one-eighth to three-fourths of an inch in size. Left bronchial gland has an incipient focus of tuberculosis. The surface of the liver shows three or four necrotic areas, which do not reveal the tubercle bacillus on microscopic examination. Entire chain of mesenteric lymph glands appear normal. Carcass passed.

Cow No. 419.—Red; common stock; 3 years old; 1 calf; bought one year ago; in fair condition and appears to be thrifty; weight, 910 pounds.

Postmortem at Fowlers, D. C., May 31, 1901: Two small nodules, size of hazelnuts, in principal lobe of right lung and three similar foci in ventral lobe of the opposite lung. One pea-sized focus in anterior mediastinal lymph gland. Carcass passed.

Cow No. 944.—Holstein grade; 4 years old; 1 calf; raised; appears healthy and in fair condition; weight, 745 pounds.

Postmortem at Fowlers, D. C., March 26, 1901: Cephalic lobe of left lung shows one tubercular focus, size of a pea, in a caseous condition. Left bronchial lymph gland contains a small focus in the semicalcareous stage. Other organs apparently normal. Carcass passed.

It is shown by the postmortem notes above that the lesions manifested at the autopsy were not excessive nor of a chronic nature, which would further indicate that the record of the tuberculin test for the first injection was correct, and that the cows had been infected subsequent to the first test, or that they were even then infected, but without the bacilli being in sufficient quantity to cause a pyrexia in consequence of the tuberculin. The only cow in which the disease was in any way extensive was No. 373, and, as this animal was not slaughtered until four months after the second test and ten months after the first injection, ample time had elapsed to account for the extent of the infection even after the second test.

The third tuberculin injection was made three months later, and of the 18 cows tested not a single one showed a rise of temperature.^a Shortly after this the superintendent of the Insane Asylum placed a

^a Owing to these temperatures being normal, it was not deemed essential to record them here.

competent veterinarian in charge of the cattle, and it will be of interest to know the results of the methods thus far pursued for the complete extermination and suppression of tuberculosis in this herd.

The tuberculous animals having been slaughtered, a new herd was started by the purchase of thrifty and vigorous grade cattle that successfully passed the tuberculin test. These cows are at present occupying the barns after thorough disinfection, a complete renovation of the premises, and with improved ventilation and hygienic surroundings in general. Thus having removed, so far as possible, the tubercle bacilli themselves and also their source, it remains to be seen what effect these sanitary measures will have upon the prevention of tuberculosis in the present apparently healthy herd. It has been repeatedly demonstrated in a practical manner that tuberculosis can be completely eradicated from an infected herd and the latter subsequently kept free from the disease, which leads to the belief that, in consequence of the methods of sanitation adopted for the herd under consideration and by occasional tuberculin tests, together with the purchase of only tuberculinized cattle, similar results may be attained in this instance.

SUMMARY OF RESULTS OF TUBERCULIN TESTS.

The result of the first tuberculin test of 102 cows shows a decisive reaction in 76 animals with 1 cow giving a suspicious rise. The second test gave 8 typical reactions out of 26 cattle injected. The third test demonstrated that the 18 cows tested were without the slightest suspicion of tuberculosis. Thus out of 146 individual injections but 1 reaction (cow No. 953) was considered questionable, and, as before mentioned, the postmortem on this animal indicated that the cause of the uncertain rise was probably occasioned either by the minute size of the lesions or the tendency toward encapsulation or both. It seems apparent from the results of the postmortem held on the 8 cows which reacted to the second test that these animals were either not diseased at the time of the first test or, if so, to such a slight degree as to render detection impossible by any known means. In no case where an animal reacted to the tuberculin test did the postmortem fail to show that the cause for the reaction had been tuberculosis. The remaining 18 nonreacting cows are in good thrifty condition, and may be presumed to be healthy after passing three tuberculin tests without giving the least suspicion of a rise in temperature. The length of the period between the injection of the tuberculin and the following reaction varies from eight to eighteen hours, and cow No. 70 is an excellent example of an animal that might be passed as sound if the subsequent temperatures are not followed for at least eighteen hours after the injection. Finally the results obtained from the test of these cows support the good reputation which tuberculin merits as a diagnostic agent.

CONCLUSIONS.

From the results of the experiments conducted in this laboratory, as well as from the majority of similar investigations quoted in this article, the following conclusions regarding the infectiousness of milk from tuberculous cows seem justifiable:

1. The tubercle bacillus may be demonstrated in milk from tuberculous cows when the udders show no perceptible evidence of disease, either macroscopically or microscopically.

2. The bacillus of tuberculosis may be excreted from such an udder in sufficient numbers to produce infection in experimental animals both by ingestion and inoculation.

3. That in cows suffering from tuberculosis the udder may, therefore, become affected at any moment.

4. The presence of the tubercle bacillus in the milk of tuberculous cows is not constant, but varies from day to day.

5. Cows secreting virulent milk may be affected with tuberculosis to a degree that can be detected only by the tuberculin test.

6. The physical examination or general appearance of the animal can not foretell the infectiveness of the milk.

7. The milk of all cows which have reacted to the tuberculin test should be considered as suspicious, and should be subjected to sterilization before using.

8. Still better, tuberculous cows should not be used for general dairy purposes.

ACKNOWLEDGMENTS.

In conclusion, the writer desires to express his obligations to Dr. V. A. Nørgaard, formerly chief of this division, under whose supervision and in conjunction with whom this investigation was conducted; also, to acknowledge his appreciation of the courtesy and liberality with which the superintendent and pathologist of the Government Asylum for the Insane met every request. Thanks are also extended to Dr. J. S. Buckley, veterinary inspector, and to Dr. H. A. Christmann, formerly laboratory assistant, for their services rendered in making physical and post-mortem examinations of a large number of cattle; to Dr. J. R. Stewart, laboratory assistant, for his aid in the three tuberculin tests and in the inoculation and postmortem examination of guinea pigs, and to Dr. J. W. Fink, veterinary inspector, for his assistance in the second tuberculin test, and in the preparation of microscopic specimens.

BIBLIOGRAPHY.

ADAMI, J. GEORGE.

- 1899.—On the significance of bovine tuberculosis and its eradication and prevention in Canada. <Philadelphia Medical Journal, Philadelphia, v. 4, No. 27, Dec. 30, pp. 1277-1284.

ANNETT, H. E.

- 1900.—Tubercle bacilli in milk, butter, and margarine. <Lancet, London, v. 1, No. 3986, Jan. 20, pp. 159-162.

BANG, B.

- 1885.—Ueber die Eutertuberculose der Milchkühe und über "tuberculöse Milch." <Deutsche Zeitschrift für Thiermedizin und vergleichende Pathologie, Leipzig, Bd. II, pp. 45-67.

- 1889.—Dangers du lait tuberculeux. <Comptes rendus et Mémoires du Congrès pour l'étude de la tuberculose chez l'homme et chez les animaux, 1st session, 1888, pp. 69-72, Paris.

- 1892.—Le danger supposé de la consommation du lait et de la viande sains en apparence mais provenant d'animaux atteints de la tuberculose. <Transactions of the 7th International Congress of Hygiene and Demography, London, v. 2, pp. 193-197.

BOLLINGER, O.

- 1880.—Ueber künstliche Tuberculose, erzeugt durch den Genuss der Milch tuberculöser Kühe. (Aerztliches Intelligenzblatt, No. 47, 1879.) <Deutsche Zeitschrift für Thiermedizin und vergleichende Pathologie, Leipzig, Bd. 6, pp. 103-107.

BUEGE, A.

- 1898.—Ueber die Untersuchung der Milch auf Tuberkelbacillen. (Diss.) Halle. <Reviewed [Exp. are abstracted] in Jahresbericht über die Fortschritte in der Lehre von den pathogenen Mikroorganismen, Braunschweig, Bd. 12, p. 477 (see 989, p. 384).

- 1883.—Ueber Tuberkelbacillen im Euter einer tuberculösen Kuh und über die Virulenz des Secretes einer derartig erkrankten Milchdrüse. <Aerztliches Intelligenzblatt, München, Bd. 30, No. 16, April 17, pp. 163-164.

DELEPINE, SHERIDAN.

- 1897.—Examination of cow's milk for the detection of pathogenic properties. <Journal of Comparative Pathology and Therapeutics, Edinburgh and London, v. 10, No. 2, June 30, pp. 150-156; No. 3, Sept. 30, pp. 180-206.

- 1901.—How can the tuberculin test be utilized for the stamping out of tuberculosis? (Abstract of paper communicated to British Congress on Tuberculosis, Section 1. Reprinted from Lancet.) <Journal of Comparative Pathology and Therapeutics, v. 14, pt. 3, Sept., pp. 230-258.

DE MAN, C.

- 1893.—Ueber die Einwirkung von hohen Temperaturen auf Tuberkelbacillen. <Archiv für Hygiene, München und Leipzig, Bd. 18, pp. 133-179.

ERNST, HAROLD C.

- 1890.—How far may a cow be tuberculous before her milk becomes dangerous as an article of food? <Bulletin No. 8, April 8, Hatch Experiment Station of the Massachusetts Agricultural College, pp. 13-24.

- 1895.—Infectiousness of milk. Published by the Massachusetts Society for Promoting Agriculture, Boston, pp. 1-38.

FIORENTINI, ANGELO.

- 1892.—Sulla possibile trasmissione della tubercolosi mediante il latte delle giovenche tubercolotiche e di un bacillo patogeno riscontrato nel latte di Pavia. <Giornale della reale Società italiana d'igiene, Milano, v. 14, p. 199.

FRIIS, ST.

- 1893.—Beitrag zur Beleuchtung der Frage über die Ansteckungsgefahr der Handelsmilch mit Bezug auf die Tuberculose. <Deutsche Zeitschrift für Thiermedizin, Leipzig, Bd. 19, pp. 115-128.

- 1894.—Fortgesetzte Untersuchungen zur Beleuchtung der Frage, ob unsere Handelsmilch Ansteckungsgefahr mit Bezug auf die Tuberculose enthält, und wo diese Gefahr in Sonderheit zu suchen ist. <Deutsche Zeitschrift für Thiermedizin, Leipzig, Bd. 20, pp. 195-202.

GALTIER, V.

1889.—Virulence du lait des vaches tuberculeuses. Dangers de l'utilisation du lait cru et des produits tels que le petit lait et le fromage obtenus avec le lait des vaches tuberculeuses. <Comptes rendus et mémoires du Congrès pour l'étude de la tuberculose chez l'homme et chez les animaux, 1st session, 1888, Paris, pp. 81-84.

GEBHARDT, FRANZ.

1890.—Experimentelle Untersuchungen über den Einfluss der Verdünnung auf die Wirksamkeit des tuberculösen Giftes. <Virchow's Archiv, Berlin, Bd. 119, pp. 127-148.

GEHRMANN, ADOLPH, and EVANS, W. A.

1900.—Microscopical examination of milk and inoculation experiments. <14th Annual Report of Illinois State Board of Live Stock Commissioners for the year 1899, Springfield, pp. 48-55.

1895.—[Cited by Gehrmann and Evans, 1900.]

GERLACH, ANDREAS CHRISTIAN.

1869.—Ueber die Impfbarkeit der Tuberkulose und der Perlsucht bei Thieren, sowie über die Uebertragbarkeit der letzteren durch Fütterung. (Auszug aus dem Jahresbericht der k. Thierarzneischule zu Hannover, 1869, pp. 127-151.) <Virchow's Archiv, Berlin, Bd. 51, 1870, pp. 290-307.

GLUGE.

1850.—[Cited by Dr. Albert Johne in Die Geschichte der Tuberculose, mit besonderer Berücksichtigung der Tuberculose des Rindes, Leipzig, 1883, p. 43.]

HILLS, J. L., and RICH, F. A.

1894.—Bovine tuberculosis. <Bulletin No. 42, Vermont Agricultural Experiment Station, Burlington.

HIRSCHBERGER, K.

1889.—Experimentelle Beiträge zur Infectiosität der Milch tuberculöser Kühe. (Inaugural-Dissertation, Leipzig, 1889.) <Reviewed in Münchener medicinische Wochenschrift, München, Bd. 36, p. 739.

IMLACH, FRANCIS.

1884.—Report on the transmissibility of bovine tuberculosis through milk to young animals. <British Medical Journal, v. 2, No. 1230, July 26, pp. 175-176.

JOHNE, ALBERT.

1883.—Geschichte der Tuberculose, mit besonderer Berücksichtigung der Tuberculose des Rindes, Leipzig, p. 32.

KANTHACK, A. A., and SLADEN, SYDNEY ST. B.

1899.—Influence of the milk supply on the spread of tuberculosis. <Lancet, London, v. 1, No. 3933, Jan. 14, pp. 74-79.

KLEBS, E.

1873.—Die künstliche Erzeugung der Tuberculose. <Archiv für experimentelle Pathologie und Pharmakologie, Leipzig, Bd. 1, pp. 163-180.

KUDINOW, N. P.

1898.—Bacteriologische Untersuchungen der in Jurjew verkäuflichen Milch, Magister-Dissertation. <Reviewed by J. Waldmann in Zeitschrift für Thiermedizin, Bd. 2, No. 2, pp. 147-151.

LAW, JAMES.

1894.—Tuberculosis in relation to animal industry and public health. <Bulletin 65, Cornell University Agricultural Experiment Station, Veterinary Division, Ithaca, N. Y., April, pp. 105-157.

LIVERPOOL.

1897.—Tuberculosis as affecting the milk supply. (Abstract of report of health officer of Liverpool.) <Veterinary Journal (in notes and news), London, v. 45, July, pp. 68-69.

[MACFADYEN, ALLEN.]

1899.—Spread of tuberculosis by milk. A report to the Hackney vestry. [Editorial containing a letter by Allen MacFadyen.] <Lancet, London, v. 2, No. 3969, Sept. 23, pp. 849-850.

MARCONI, GIUSEPPE.

- 1900.—Il latte di vacca a Napoli in rapporto con l'igiene e con la tubercolosi. <La Riforma Veterinaria, v. 3, No. 10, October, pp. 435-452; No. 11-12, Nov.-Dec., pp. 483-559.

MARTIN, HIPPOLYTE.

- 1884.—Recherches ayant pour but de démontrer la fréquence de la tuberculose, consécutive à l'inoculation de lait vendu, à Paris, sous les portes cochères. <Revue de Médecine, Paris, v. 4, pp. 150-161.

MASSONE.

- 1897.—Ueber das Vorkommen des Tuberkelbazillus in der Genueser Marktmilch. <Review in Zeitschrift für Fleisch- und Milchhygiene, Bd. 8, No. 2, November, p. 35, of original which appeared in Annali d'igiene sperimentale, 1897.

MAY, FERDINAND.

- 1883.—Ueber die Infectiosität der Milch perlsüchtiger Kühe. <Archiv für Hygiene, München u Leipzig, Bd. 1, pp. 121-136.

McFADYEAN, J., and WOODHEAD, G. SIMS.

- 1892.—On the transmission of tuberculosis from animals to man, by means of flesh and milk derived from tuberculous animals. <Transactions of the 7th International Congress of Hygiene and Demography, London, v. 2, pp. 197-203.

NOCARD, ED., and LECLAINCHE, E.

- 1896.—Les maladies microbiennes des animaux, Paris, p. 583.

NOCARD, ED.

- 1884-85.—Research for the bacillus of Koch, in the expectorate of phthisical cattle; application to the diagnosis in doubtful cases. (Translated from Archives Vétérinaires.) <American Veterinary Review, New York, v. 8, No. 6, Sept., pp. 258-268.

OBERMÜLLER, KUNO.

- 1897.—Ueber Tuberkelbacillenbefunde in der Marktbutter. <Hygienische Rundschau, Berlin, Jahrgang 1, No. 14, July 15, pp. 712-714.

OSTERTAG, ROBERT.

- 1899.—Untersuchung über den Tuberkelbazillengehalt der Milch von Kühen, welche lediglich auf Tuberkulin reagiert haben, klinische Erscheinungen der Tuberculose aber noch nicht zeigen. <Zeitschrift für Fleisch- und Milchhygiene, Berlin, Bd. 9, No. 12, September pp. 221-232.

OTT, J.

- 1898.—Ein weiterer Beitrag zur Milchhygiene. <Zeitschrift für Fleisch- und Milchhygiene, Berlin, Bd. 8, No. 4, January, pp. 69-74.

PEARSON, LEONARD.

- 1893.—Proceedings of the 30th Annual Convention U. S. V. M. A., p. 338.

PETRI, R. J.

- 1898.—Zum Nachweis der Tuberkelbazillen in Butter and Milch. <Arbeiten aus dem Kaiserlichen Gesundheitsamte, Berlin, Bd. 14, p. 1.

PEUCH, F.

- 1889.—Sur la contagion de la tuberculose par le lait non bacilli et la viande crue. Nouvelles expériences sur le porc et le lapin. <Comptes rendus et mémoires du Congrès pour l'étude de la tuberculose chez l'homme et chez les animaux, 1st session, 1888, Paris, p. 73.

RABINOWITSCH, LYDIA, and KEMPNER, WALTER.

- 1899.—Beitrag zur Frage der Infectiosität der Milch tuberculöser Kühe, sowie über den Nutzen der Tuberculinimpfung. <Zeitschrift für Hygiene und Infectiouskrankheiten, Leipzig, Bd. 31, pp. 137-152.

RABINOWITSCH, LYDIA.

- 1897.—[Cited by Rabinowitsch and Kempner, 1899.]

- 1900.—Ueber die Gefahr der Uebertragung der Tuberculose durch Milch und Milchprodukte. <Deutsche medicinische Wochenschrift, Leipzig, v. 26, No. 26, June 28, pp. 416-418.

RAVENEL, MAZŮCK.

1897.—Tuberculosis and milk supply. <Public health papers and reports of the American Public Health Association, Concord, N. H., v. 23, pp. 289-296.

ROGER and GARNIER.

1899.—Cited by Marcone, in *Il latte di vacca a Napoli in rapporto con l'igiene e con la tubercolosi*, in *La Riforma Veterinaria*, Naples, v. 3, No. 11-12, Nov.-Dec., 1900, p. 511.

RUSSELL, H. L.

1895.—Infectiousness of milk from tuberculous cows. <Eleventh Annual Report of the Agricultural Experiment Station of the University of Wisconsin for year ended June 30, 1894, Madison, Wis., pp. 196-197.

SACHARBEKOW.

1893.—Cited by Marcone, in *Il latte di vacca a Napoli in rapporto con l'igiene e con la tubercolosi*, in *la Riforma Veterinaria*, Naples, v. 3, No. 11-12, Nov.-Dec., 1900, p. 510.

SCHROEDER, E. C.

1894.—Further experimental observations on the presence of tubercle bacilli in the milk of cows. <Bulletin No. 7, Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C., pp. 75-77.

SEMMER, E.

1875-76.—Versuche über die Uebertragbarkeit der Tuberculose (Perlsucht) der Rinder auf andere Thiere. <Deutsche Zeitschrift für Tiermedizin und vergleichende Pathologie, Leipzig, Bd. 2, pp. 209-220.

SMITH, THEOBALD, and SCHROEDER, E. C.

1893.—Some experimental observations on the presence of tubercle bacilli in the milk of tuberculous cows when the udder is not visibly diseased. <Bulletin No. 3, Bureau of Animal Industry, United States Department of Agriculture, Washington, pp. 60-66.

STEIN, GOTTLIEB.

1884.—Experimentelle Beiträge zur Infectiosität der Milch perlsüchtiger Kühe. Inaugural-Dissertation, Berlin.

WESENER, F.

1885.—Kritische und experimentelle Beiträge zur Lehre von der Fütterungstuberculose, Freiburg i. B, p. 25.

Z[sCHOKKE].

1884.—Ein Weiteres zur Frage der Tuberkulosis. <Schweizer Archiv für Thierheilkunde, Zürich, Bd. 26, pp. 262-267.

ZURN, FRIEDRICH ANTON.

1872.—Zoopathologische und zoophysiologische Untersuchungen für die landwirthschaftliche Versuchsstation zu Jena in den Jahren 1868-71 ausgeführt, Stuttgart, p. 11.

13362—No. 44—03—7